AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 22 JUNE, 1939 NUMBER 6

GUMMA OF THE ORBIT*

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Of all the conditions in which the ophthalmologist must make a differential diagnosis the most difficult is that of unilateral exophthalmos. Excluding the acute phlegmons of the orbit, cavernous-sinus thrombosis, and arteriovenous aneurysm, in which the diagnoses are usually obvious, every ophthalmologist has been confronted with the patient who has a slowly progressive exophthalmos in which the diagnosis has been most obscure, sometimes made only through the natural history of the disease, and sometimes not made at all. One of the conditions producing such exophthalmos, which because of its rarity is unfortunately often not considered till late, is gumma of the orbit.

CASE REPORTS

Case 1. A negress, aged 37 years, presented herself on March 16, 1937, complaining of pain and impairment of vision in the left eye of two weeks' duration.

The patient stated that she had first noted intermittent diplopia about one month previously. At that time she had begun to experience an aching pain in the left eye, radiating to the left frontal area. One week after the onset the diplopia disappeared and she noticed that the vision in the left eye was poor. She consulted an optometrist, who prescribed lenses. The pain became more severe and continuous, keeping her awake at night. The vision continued to decrease, and upon returning to the optometrist the patient was advised that she needed a stronger lens. At this time she observed that the eye protruded slightly and the lid drooped, and came to the Stanford Eye Clinic for advice.

In December, 1930, the patient had had an ischiorectal abscess, associated with extensive rectal strictures. The blood Wassermann had been four plus; the patient, however, denied any symptoms of primary or secondary lues. Continuous antiluetic therapy was given through 1931, consisting of neosalvarsan, mercury, and bismuth injections. She had received no treatment since that time. A blood Wassermann test taken in December, 1936, had been strongly positive, but the patient had failed to return for further treatment.

Ocular Examination: Vision in the right eye was 15/15, there was no evident pathology and the visual field was normal. In the left eye there was no light perception. A moderate ptosis was present, the lid margin covering the upper half of the pupil. The globe protruded slightly, directly forward. The exophthalmometer reading for the right eye was 18.5 mm.; for the left eye, 20.5 mm.

Except for slight upward rotation, less than five degrees, the left eye was immobile (fig. 1A). The little finger could be inserted between the orbital margin and the globe in all meridia to the equator without encountering abnormal resistance. The pupil was semidilated, slightly irregular, and failed to react to direct light. A prompt consensual reaction was ob-

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tained and a prompt reaction to convergence. Corneal sensitivity was normal. The optic disc was slightly pale in the temporal half and the markings of the lamina cribosa were more prominent than in the right eye. Sensation over the distribution of the supraorbital nerve was normal.

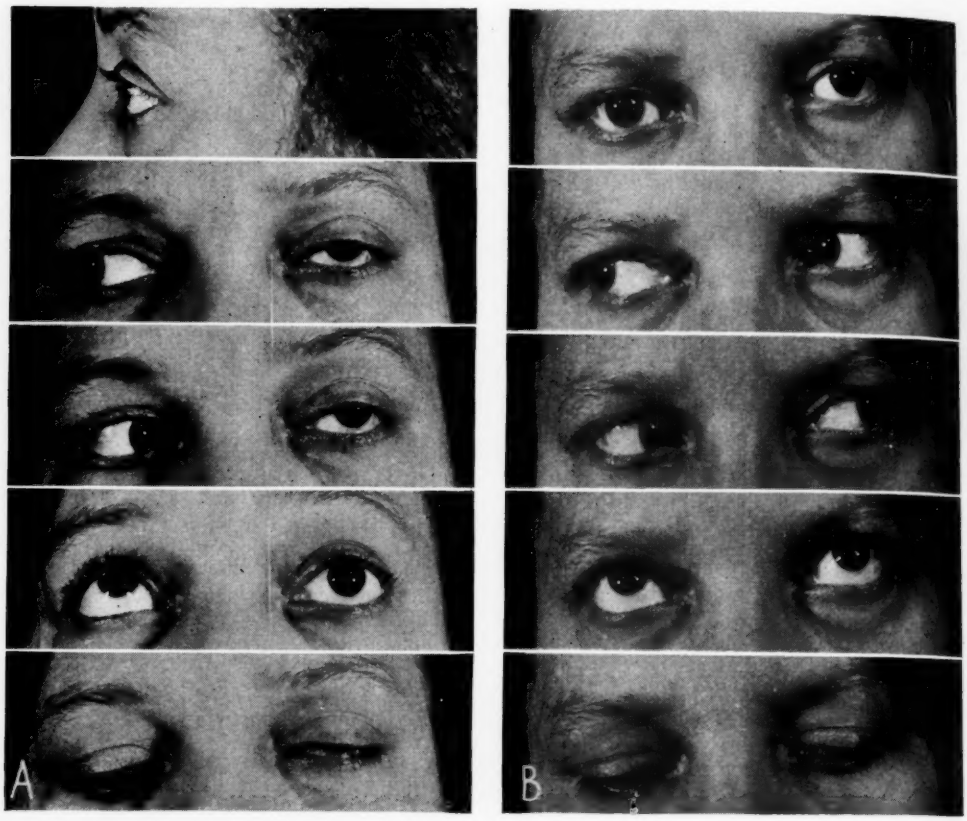

Fig. 1 (Fine). Case 1. A, as of March 17, 1937; B, as of May 8, 1937.

Upon general examination, no clinical evidence of lues was found. Laboratory examinations were negative as to the spinal fluid and urine. An X-ray study of the orbit showed no pathology.

Impression: Gumma of the left orbit.

Treatment: The patient was given injections of iodobismitol twice weekly and potassium iodide 40 grains daily. On April 23, 1937, a very slight ptosis remained. The ocular rotations were normal except for a slight weakness of the inferior rectus (fig. 1, B). The exophthalmos had receded completely. Light perception was present and there was a good pupillary reaction. The pallor of the disc had increased somewhat.

On May 21, 1937, the patient was able to count fingers at about one foot in the nasal field. There was no central nor temporal vision. Ocular rotations were entirely normal. The disc had become very pale. The blood Wassermann was now negative. Bismuth and potassium iodide were discontinued, and a course of neoarsphenamine was begun.

Case 2. A Negress, a domestic, aged 27 years, divorced, presented herself on De-

cember 10, 1937, complaining of a swelling over the right eye of two months' duration and severe headache for the past two weeks.

The patient stated that about two months previously she had noticed a small nontender nodule at the upper margin of the orbit. This nodule had slowly increased in size to the present time. In the past two weeks the swelling had been somewhat tender and during this time of the upper lid, but the pupil remained uncovered. The upper lid showed diffuse, nonpitting edema with slight erythema. A smooth, rounded nodule, about 1 cm. in diameter, of rubbery consistency, slightly tender, was attached to the middle portion of the supraorbital ridge. The nodule was only slightly movable. Its lower margin could not be accurately outlined because of the surrounding edema—it appeared to continue under the margin

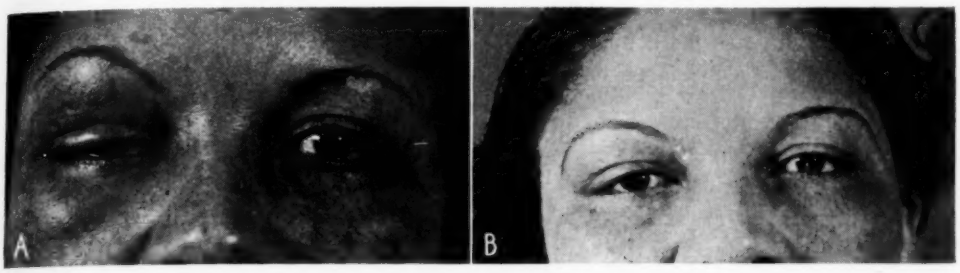

Fig. 2 (Fine). Cast 2. A, as of December 13, 1937; B, as of January 27, 1938.

also she had experienced severe frontal and parietal headaches, which had become increasingly worse and were most severe during the night. At times the pain seemed to arise in the right orbit and radiate upward. During the past month she had had a chronic running nose, as from a head cold, and had noticed that the senses of smell and taste seemed diminished. One week previously, while blowing the nose, she had discharged a small piece of bone "like crab shell" from the right nostril. She had felt well generally and there had been no loss of weight. There had been no impairment of vision.

The patient denied any history of luetic symptoms or anti-luetic treatment, by name and description. No blood test had been taken prior to the present illness.

Ocular Examination: Vision in the right eye was 15/40; corrected to 15/15 each eye.

Right eye: There was a moderate ptosis of the ridge into the orbit for a short distance. There was slight edema and redness of the lower lid (fig. 2, A). Sensory discrimination over the distribution of the supraorbital nerve was normal. The conjunctiva of the lids was slightly hyperemic. The cornea was clear; its sensitivity normal. Iris and pupil showed normal reaction to light and convergence, with normal consensual reaction. The tension (digital examination) was normal. Ophthalmoscopic examination of the fundus showed no abnormalities of the disc, retina, or vessels. The extraocular muscles allowed normal rotations in all directions. The visual fields were normal—3/330 white and 2/330 red and green.

Physical examination: No abnormalities were found except in the nose. The right septum was convex in its mid portion with an ulcerated granular mass touching the middle turbinate. The left side presented a similar appearance. A probe introduced in this area passed

through the septum, there being a perforation at the junction of the cartilage and the vomer.

Laboratory examination: An X-ray film of the orbit revealed no pathology. The blood Wassermann reaction was four plus.

Impressions: Gummatous periostitis of supraorbital ridge; gumma of nasal septum with perforation.

Treatment: Antiluetic treatment was begun in the syphilis clinic on December 16, 1937, with prescription of sobisminol (oral bismuth) 1.2 gm. daily. On December 27, 1937, there was a definite decrease in the size of the tumor. The patient stated that she had regained the sense of smell. There was no evidence of bismuth toxicity. On January 6, 1938, a very marked decrease in the size of the gumma had taken place. A small, nontender nodule the size of a hazelnut could now be felt, attached to the under surface of the superior orbital margin (fig. 2, B). The patient had been free from headaches or pain for two weeks.

January 27, 1938, the blood Wassermann test was repeated: four plus.

By February 10, 1938, there had been complete involution of the gumma. Only a slight residual thickening of the orbital margin remained. Examination on February 24, 1938, showed no difference between the right and left orbits.

Discussion

The two cases of gumma of the orbit reported herewith are the only two on record in the Stanford Clinic since 1913, in which year the present system of records was begun. During this period approximately 40,000 patients were seen in the eye department and 271,000 in all departments. Kemp[1] reported that of 6,000 cases of syphilis at the Johns Hopkins Hospital only five cases of orbital syphilis occurred, and stated that he had collected 150 cases of syphilis of the orbit from the literature. Birch-Hirschfeld,[2] at the Leipzig clinic, found that syphilis of the orbit constituted .01 percent of ocular disease. All of these statistics indicate that the condition is very rare. The author, reviewing the available literature of the past 25 years, found 24 reported cases in which the diagnosis of orbital syphilis was established. The numerous cases of orbital pseudotumor in which the Wassermann reaction was negative and in which there was no history or clinical evidence of syphilis have not been considered in this review, although undoubtedly a number of these that vanished under administration of potassium iodide must have been gummas. For brevity these cases are presented in tabular form.

It is interesting to note that of the 24 recorded cases, 5 were bilateral, although the onset was not simultaneous in the two orbits. It is probable that this apparently high incidence of bilateral occurrence of orbital gumma may be explained by the fact that many unilateral cases are not reported, while the unusual feature of bilaterality is reported more constantly. It is possible, however, that an organotropic mechanism may be concerned, witness the relative frequency of bilateral luetic uveitis.

Diagnosis. The common symptoms and signs that lead to a diagnosis of orbital gumma are pain, exophthalmos, and impairment of function of one or more of the nerves within the orbit; namely, the optic nerve, oculomotor, trochlearis, abducens, and the ophthalmic and maxillary divisions of the trigeminal. The extent of this involvement depends on the situation, size, and duration of the lesion. The instances of orbital gumma may be divided into two anatomical groups—those that occupy the apex of the orbit and those that involve the marginal portion of the orbit, including the lacrimal fossa. The two cases reported here are prototypes

of these two groups. Obviously the marginal lesions will produce no exophthalmos nor nerve palsies. Pain, however, is a common symptom and may be very severe, radiating to the frontal region and to the eyeball. This symptom is frequently the first and may precede other signs and symptoms by weeks or even months. Severe orbital pain or frontal headache are described as the initial symptoms in eight of the recorded cases. Increased intensity of the pain at night appears to be characteristic. The neoplasms of the orbit are, as a rule, painless, and the symptom of

TABLE 1

RECORDED DATA ON CASES OF GUMMA OF THE ORBIT FOUND IN THE LITERATURE

No.	Author	Age	Sex	Proptosis	Motility	Vision	Fundus and Fields
1	Williamson-Noble[6]	25	M	Marked	Limited 3 wks. after onset	6/12	
2	Hine[7]	69	M	Appeared 2 mos. after onset		H.M.	Choked disc
3	Taylor[8]	30	F	R. Marked L. Appeared after removal of R.E.	Limited		
4	Nelissen and Weve[9]	49	F	Marked	Immobile; ptosis	Reduced	Field constricted
5	Dodd[10]	31	F	Moderate	Partial paresis III	12/200	
6	Kalt[5]	35	M	R. Marked; forward L. Forward and downward	Immobile; ptosis Immobile	1/10 1/50	Hyperemia of disc
7	Musial[11]	49	M	R. Moderate L. Marked	Limitation of upward rotation Immobile; lagophthalmos	10/10 Blind	Papilledema
8	Kurz[12]	65	F	3 mm.	Normal		Disc pale, field constricted
9		3		Present 1 year	Total paresis III		
10	LeWin and White[13]	42	M	Present	Limitation of upward rotation	6/60	Retinal edema
11	Paunel[14]	38	M				
12	Seefelder[15]	52	F	Present		6/6	Choked disc
13	Oriechkin[16]	39	M	Present	Limited upward and downward	8/10	
14	Werner[17]	50	F	R. L.			
15	Cantonnet and DeSaint Martin[18]	34	M	Rapidly progressive forward and down	Slight external rotation only	9/10	
16	Kemp[1]	34	M	Marked	Immobile; ptosis	20/40	Normal
17		34	M	Present	Paresis superior rectus	20/100	Retinal veins full
18		45	M	Present	Limitation in all directions; ptosis	Light perception	Choked disc
19		30	M	4 mm.	Paresis right external rectus	20/20	Veins congested
20	Desiderio[19]	39	M	Slight	Limited in all directions; convergent strabismus	Fingers at 3 m.	
21	Löhlein[20]	51	M	7 mm.	Moderate limitation in all directions		
22	Raffin[4]	29	F		Ptosis; divergent strabismus	5/5	Normal
23		28	F				
24	Pascheff[21]	43	F	R. Forward and upward L. Slightly forward	Marked limitation except upward	H.M. 6/20	Optic nerve atrophic Optic neuritis

TABLE 1 (*Continued*)

RECORDED DATA ON CASES OF GUMMA OF THE ORBIT FOUND IN THE LITERATURE

Other Signs and Symptoms	Blood Wass.	Treatment	Histologic Examination. Course.
	Neg.	Mercury and KI for 5 wks. Exenteration of Orbit KI. No improvement in 2 mos. Exenteration Mercury and KI without improvement. Exenteration Mercury and KI to point of dysentery	Gumma, moulded against sclera and surrounding the optic nerve Chronic inflammatory mass with marked changes in blood vessels "suggesting syphilitic origin" "Organizing gumma" Complete recovery
Severe headache. X-ray shadow in antrum	Pos.	Antiluetic	Improvement 2 wks. After 2 mos. only partial oculomotor paresis remained
Draining supraorbital sinus	Pos.	Frontal sinus operation. KI and mercury rubs when Wassermann found +	Gumma of orbital margin. Complete recovery in 6 wks.
Ulceration of cornea. Severe keratitis and iritis	Neg.	Antiluetic therapy 2 mos. Bilateral biopsy. Antiluetic therapy resumed more intensively	Bilateral gumma. Complete disappearance of proptosis and ptosis after 3 mos. Slight residual limitation of movements. Vision R.E. 2/10, L.E. 1/10
Swelling of lids 1½ yrs. Keratitis	Neg. Sp. Fl. +	Biopsy	Gumma
Tenderness lower orbital margin. Severe headache	Pos.	Antiluetic	Complete recovery
Congenital lues	Pos.	Antiluetic	Immediate improvement. Pupil remained dilated and fixed
X-ray shadow in orbit	Pos.	KI and bismuth	Immediate recovery. Vision 6/6. Slight pallor of disc
2 periorbital nodular masses	Pos.	Antiluetic	Rapid disappearance of tumors
Swelling of lids	Neg.	Ethmoid operation with no result. Mercury rubs .3 G. Salvarsan	Complete recovery in 6 wks.
Small node lower temporal margin of orbit	Pos.	Clinical diagnosis of fibrosarcoma. Excision	Complete recovery in 1 wk. "Recidiv reaction" after 2 mos. Followed by complete recovery with 40 injections mercury, and KI Inflammatory cells with marked endarteritis and periarteritis: gumma. Symmetrical tumor occurred L.E. 8 mos.
Symmetrical tumor		4 injections Salvarsan	Complete disappearance of tumor 1 mo.
X-ray of orbit neg.	Pos.	Mercury cyanide .01 G. daily	Exophthalmos began to recede in 17 days. Complete recovery in 6 wks.
Aching rt. forehead. Pupillary reactions poor. Anesthesia supraorbital nerve	Neg.	KI Grains 120 daily. Arsphenamin weekly	Return of function external rectus 2 days after first injection. Complete recovery except slight residual exophthalmos in 1 mo. Vision 20/20
Pain, numbness in forehead 1 mo. Anesthesia supraorbital nerve	Pos.	One dose arsphenamin. Pt. did not return	After single injection all symptoms improved. 23 mos. later slight exophthalmos, normal motility and vision. No disturbance of V. nerve
Pain in face. Left pupil fixed. Gumma of pharynx	Pos.	3 injections arsphenamine. Pt. did not return for 8 yrs.	Reduction exophthalmos after 3 injections. 8 yrs. later: no exophthalmos, normal motility, secondary optic atrophy.
Pain in orbit 2 yrs. before relieved by mercury rubs	Pos.	Neoarsphenamin. Mercury rubs daily	After one mo. exophthalmos 1.5 mm., slight esophoria. Eye entirely normal 8 mos. later
Severe frontal and orbital pain; corneal and supraorbital anesthesia		Antiluetic	Complete recovery
Severe orbital pain and frontal headache. History of early lues	Neg.	Antiluetic	Complete recovery in 3 wks.
Severe pain in head and ear. Small swelling above L.E. Maculopapular rash	Pos.	Antiluetic	Complete recovery in 1 mo.
Gummatous periostitis of lacrimal fossa. Luetic lesion in nose		Antiluetic	Complete recovery
Thickening of lower orbital margin, extending into orbit as a hard mass	Pos.	Neoarsphenamin. Mercury rubs, KI. Biopsy	"Necrotic zone surrounded by zone of lymphocytes, fibroblasts, plasma cells and giant cells. Perivascular infiltration with thickening of vessel walls: syphiloma." Complete recovery of position and motility.
4 mos. later a symmetrical tumor of L.E. appeared		Biopsy	Complete recovery in 2 mos.

pain may serve as a valuable differential sign (Igersheimer[3]). When the lesion is situated near the rim of the orbit there is usually some tenderness to pressure, though not very marked. The pain of an intraorbital gumma may be increased when pressure is made on the globe.

Exophthalmos is a constant sign of intraorbital gumma. The superior wall of the orbit is the most common site of origin and the resulting displacement of the globe is usually directly forward or forward and downward. The exophthalmos is not reducible by pressure; this may

serve as a differential sign in ruling out proptosis due to angiomata of the orbit or orbital edema associated with infections of the regional paranasal sinuses. Pressure of the gumma on the veins may produce congestion of the orbit and contribute to the exophthalmos. Kemp has described dilation of the veins of the temple in association with such a lesion. X-ray examination of the orbit is usually of little diagnostic aid, the findings usually being negative. Raffin[4] describes two types of orbital syphilis: (1) an exudative hyperplastic periostitis with thickening of the periosteum; (2) a gummatous periostitis with a circumscribed tumor of soft consistency. The latter type, occurring in the tertiary stage, is the more common and this fact probably explains the absence of positive X-ray findings.

Involvement of the extraocular muscles through pressure paralysis of the motor nerves occurs in practically every case of intraorbital gumma. This involvement progressed to complete immobilization in one third of the collected cases. Paresis of the external rectus is the most common onset of the immobilization. Ptosis and superior-rectus paralyses are next in frequency.

The optic nerve may be affected in several ways. Most often there is papilledema followed by secondary atrophy. Occasionally, there is optic atrophy without signs of congestion. Kemp mentions retrobulbar neuritis followed by atrophy as occurring frequently, but a review of the reported cases does not bear this out. In our second patient there was complete blindness with only a slight pallor of the disc. This was followed by optic atrophy of the primary type.

Paresthesias of forehead and cheek may occur from irritation of the first and second branches of the trigeminus. Depending on whether the nerve involvement is in the irritative or destructive stage, there may be hyperesthesia or hypesthesia. Keratitis neuroparalytica has been reported rather infrequently, complete anesthesia of the cornea being uncommon.

The Wassermann reaction is important in the diagnosis of gumma of the orbit, and, indeed, in most cases the diagnosis rests on the presence of one or more of the signs described above and a positive Wassermann reaction. It is, however, to be kept in mind that in 6 of the 26 collected cases (22 percent) the blood Wassermann was negative. In one of these the spinal fluid was positive.

Treatment. As with gummas elsewhere, there is probably no disease in which the results of treatment are as gratifying as in gumma of the orbit, provided it is instituted before the nerve changes have become irreversible. Recovery usually comes within three to six weeks irrespective of the type of antiluetic therapy used. The combination of potassium iodide with one of the heavy metals (mercury or bismuth) as in other late luetic processes, affords a safe and effective antiluetic therapy.

It must be remembered that the response to antiluetic therapy is not always immediate. In several of the cases reported no decrease in exophthalmos was noted until three weeks had elapsed. Where a therapeutic trial is being made, in the presence of a negative Wassermann reaction, therapy should not be abandoned for at least one month. In the case reported by Kalt,[5] antileutic therapy was given for two months without improvement. When biopsy proved the lesion to be a gumma more intensive therapy was instituted, with good recovery. When potassium iodide is used the dosage should be adequate (40 to 100 grains daily). The minute doses which are often prescribed only serve to confuse the diagnosis.

In any case of suspected orbital tumor in which the diagnosis is not apparent, a therapeutic trial of antiluetic therapy is indicated, regardless of the Wassermann reaction. This rule, stated by Meller 25 years ago, has been made no less applicable today by the advances in syphilology and ophthalmology.

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LECTURES ON MOTOR ANOMALIES*

X. Supranuclear paralyses

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The disorders of the movements of the eyes caused by lesions of peripheral origin—namely, of the nuclei and the individual motor nerves—have been discussed previously. If a lesion is situated above the nuclei, injuring the supranuclear apparatus—that is, the pathways between the nuclei and the cortical, the subcortical, or the vestibular centers—paralysis of associated muscle groups of both eyes occurs as a rule. The few exceptions to this rule are the paralyses caused by a lesion of the posterior longitudinal bundle or those in the immediate neighborhood of the nuclei of the oculomotor nerves. Such a lesion can deprive one internal rectus muscle of the faculty of adduction in lateral movements, leaving intact its convergence function, or it can make the elevator muscles of one eye incapable of producing a voluntary elevation without disturbing the involuntary elevation that takes place in Bell's phenomenon. Theoretically, supranuclear paralyses of the other individual ocular muscles are quite conceivable, but there is no way of differentiating between supranuclear and peripheral disturbances of those muscles, because they do not act as parts of different mechanisms in anything like the same degree as the internal rectus muscles act in lateral and in convergence movements, or as the elevators act in obeying the elevation impulse and the impulse to shut the eyes. Therefore, but for the few exceptions just mentioned, the diagnosis of a supranuclear lesion is based chiefly on bilateral and equal paralysis of associated muscle groups.

I shall discuss, first, associated paralysis of the parallel lateral movements, the symptoms of which have been studied mostly in paralyses caused by lesions of the associated pathways either within or near the pons and the region of the fourth ventricle. In an uncomplicated case of this type, both eyes being unable to move to the right, for instance, are deviated slightly to the left. This deviation induces the patient to turn his head a little to the right in order to look at an object straight in front of him. No diplopia is present because of the equality of the deviation of the two eyes. When the patient is ordered to look at an object on the right, neither eye can move beyond the midline; or if the movement is not completely lost, the restriction of the movement is equal in both eyes, so that binocular single vision is not disturbed. In such a case jerky nystagmus to the right reveals the repeated futile efforts to direct the eyes toward the object in the right periphery of the field of fixation. Strict proof of the supranuclear origin of such a paralysis is given by the intact convergence function of the left internal rectus muscle, which is unable to advert the left eye only when a parallel movement is called for, whereas its reaction to convergence impulses is normal. From this behavior it must be concluded that the nerve to the left internal rectus and its nucleus, as well as the pathway descending to the latter from the convergence center, are intact, but that the pathway descending from the cortical center governing the associated

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movement to the right has been interrupted. However, it is still to be ascertained whether the paralysis of the right external rectus muscle is also caused by a supranuclear lesion. It is quite possible that a lesion of the right abducens nucleus involves the posterior longitudinal bundle as well, so that the left internal rectus fails to function when innervated together with the right external rectus. The decision will depend on how the right abducens nerve responds to a vestibular stimulation.

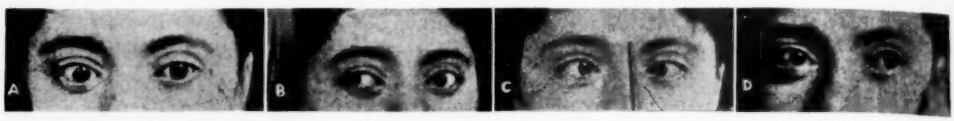

Fig. 50 (Bielschowsky). Associated paralysis of levoversion caused by an acute encephalitis pontis. A, the two eyes do not respond to the maximal levoversion impulse while (B) dextroversion, as well as (C) convergence are executed perfectly. By turning the patient's head with a sudden jerk to the right (D), levoversion to an almost normal extent can be obtained, but the eyes move back toward the original position immediately after the rotation of the head is completed. (When the photograph reproduced in D was taken, the two eyes were already moving back from the extreme levoversion toward the middle position.)

In 1901, I[1] had under observation a patient with an acute encephalitis that was localized in the pons, and had produced an associated paralysis of the parallel movement to the left, with no disturbance of the convergence function of the internal muscles (fig. 50). The patient was unable to move her eyes to the left at command, and was also unable to look at an object situated in the left half of her visual field. In the face of the apparently complete inability to move the eyes to the left, the result of the further examination was all the more surprising. While the patient was fixating an object straight in front of her I rotated her head with a sudden jerk to the right. The result was that both eyes moved to the left to a nearly normal extent, but immediately after the rotation of the head had been completed the eyes went slowly and involuntarily back to their original position—a proof of the genuine reflex character of the ocular movement that had just been produced. In a second test, while the patient was fixating an object straight in front of her I rotated her head *slowly* to the right. Again the eyes moved to the left as far as in the first test, but this time they were able to maintain fixation and to remain directed to the left as long as the head was kept rotated to the right, a proof that this time the ocular movement was caused not by a vestibular reflex action but by an innervation of cortical origin. The same effect was obtained when, instead of rotating the patient's head, the object looked at was carried very slowly to the left. Both eyes maintained fixation and followed the object as far as in the other tests and remained directed to the left for a considerable time. The ocular movement to the left produced in such a manner I called "Führungsbewegung"; Duane calls it the "following movement." It arises from the same cortical innervation as the ocular movement in the second test. I shall try to explain later how the different results arise that are obtained by making use of the tests described.

By far the most frequent of the associated paralyses of the vertical movements are the paralyses of elevation, next in frequency are the paralyses of both elevation and depression, and the rarest are the paralyses of the depression movement. In 1906 Steinert and I[2] reported on a series of cases of paralysis of the associ-

ated vertical movements, the characteristic signs and symptoms of which are shown in the following case report:

A man, aged 48 years, had paralysis of the elevator and depressor muscles following a paralytic stroke. He was unable to look either up or down at command and was likewise unable to fixate an object in his visual field above or below the horizontal plane. When he sat opposite a vision test card so that the largest letter was on a level with the horizontal plane of his eyes, he could read the largest letter but was unable to read the letters in the next line below. That this was not due to a deficiency of vision was easily proved. If the card was raised gradually the patient could read each of the lower lines as soon as it came up to the horizontal plane, thus showing that he had normal visual acuity. But after he had read the lowest line he was unable to read the larger letters, because they were at that time situated above the horizontal plane.

The same result was obtained if, instead of raising the test card, prisms of increasing strength were placed base down before the patient's eyes. He was then able to read the lower lines. When the prisms were placed base up they helped him to read the letters above the horizontal plane. But when a card with the largest letters on top was brought to the horizontal plane, a prism of 10 degrees placed, base up, before each eye made the letters illegible; similarly, if the prisms were placed base down before his eyes, the letters on the lowest line became illegible. In other words, the patient was unable to compensate for a prismatic displacement of even 5 arc degrees by a corresponding vertical ocular movement. In striking contrast to this result was the ability of the patient's eyes to follow an object to an almost normal extent when it was moved *slowly* up and down and to remain in the elevated or depressed position for a considerable time. But they were unable to return to the horizontal plane from either position without being led by the guiding object.

Another interesting experiment was as follows: The patient sat opposite a vertical tangent scale, the fixed light in the center being on a level with his eyes. At the word of command he was unable to direct the visual lines at one jump to one of the more distant numbers—for instance, to the number 5 above or below the light—whereas he succeeded in turning his eyes gradually and with a noticeable effort from the light to the number 1, from 1 to 2, and so on up to the upper or down to the lower end of the scale. It was not a normal movement, but a slow creeping of the eyes along the successive numbers above or below the light. A quick vertical movement of the patient's eyes up or down to their normal limits could be produced only when his head was turned passively up or down with a sudden jerk. In Germany this behavior is called "Puppenkopfphänomen" (doll's head phenomenon). But, as in paralysis of the lateral movements, immediately after the cessation of the passive rotation of the head, the eyes glided back automatically to the original middle position.

Finally, Bell's phenomenon was looked for. When the patient was asked to shut his eyes they went upward to the normal extent.

In some cases Bell's phenomenon is the only proof of the integrity of the nuclei in bilateral paralysis of the elevator muscles (fig. 51).

What is the significance of the various results obtained through examination of the associated paralyses by means of the methods just described? They make it possible not only to decide that a paralysis has been caused by a supranuclear lesion, but also, at least to a certain extent, to localize the lesion more precisely, since it

can be determined which of the various pathways descending to the nuclei are intact and which have been injured.

Barany's tests for ascertaining vestibular excitations present an essential improvement in the examination of the patients with associated paralyses. They can be used for bedridden or somnolent patients and, further, since the vestibular stimulus continues for about a minute, its effect can be observed much better than in the head-rotation test, which produces only a momentary excitation. Without going into the details of the various Barany tests, I wish merely to give the following data. The patient sits on a revolving stool that is rotated about 10 times. The vestibular stimulation that results from the current thus set up in the endolymph of the semicircular canals produces a labyrinthine (jerky) nystagmus toward the side of the rotation; a sudden discontinuance of the rotation brings about a secondary nystagmus in the opposite direction, lasting from 30 to 40 seconds, provided the vestibular apparatus and its connections with the nuclei of the paralyzed muscle are intact. If the patient is bedridden, somnolent, or a young child, the caloric test is preferable. After it has been ascertained by examination that the ear is normal, as it must be, water at 20°C. is syringed into the right auditory passage; from 10 to 20 seconds later labyrinthine nystagmus toward the opposite side arises if the vestibular apparatus is intact. If the patient is unconscious there will be no nystagmus but only a slow movement of labyrinthine origin toward the same side; that is, in the example chosen it will be toward the right, even if there is an associated paralysis of dextroversion of supranuclear origin. If, however, the right eye lags behind, it must be inferred that the nucleus of the abducens nerve or the nerve itself is injured.

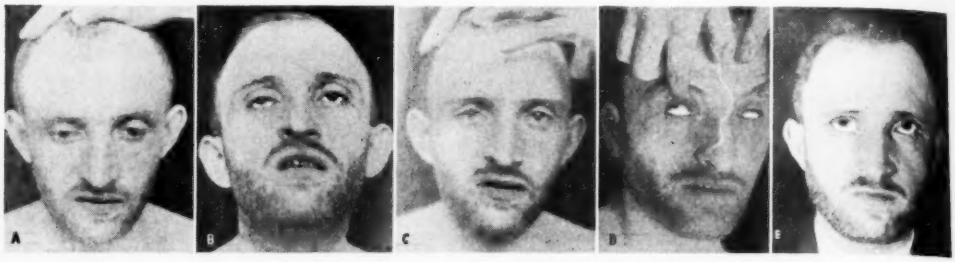

Fig. 51 (Bielschowsky). Associated paralysis of the elevator muscles caused by a tumor of the corpora quadrigemina. A, in the usual position of the eye, both visual lines are equally depressed. B, the visual lines can be raised voluntarily or at a word of command only to the horizontal plane. C, they cannot pass even if the fixed object is slowly moved upward. D, only in Bell's phenomenon, if the patient is asked to close his eyes, is a maximum elevation obtained, proof of the supranuclear localization of the lesion. E, the eyes have regained the faculty of moving upward after removal of the tumor.

As long as the paralyzed muscles respond to vestibular stimulation it may be assumed that there is integrity of the nerves, their nuclei and the pathways connecting them with the vestibular apparatus. In many instances, although a patient with this type of paralysis is unable to turn his eyes in the direction of an object or sound, either at word of command or spontaneously, he can do so if an object which he is asked to fixate will be moved in that direction. How this "following movement" is released and where the innervation concerned arises, is still an unsolved problem. Since there are several centers in the cerebral cortex—in the frontal, in the occipital, and in the

temporal lobe—that are concerned with the associated movements, some authors supposed that the innervations causing the "following movement" and the willed or commanded movement are derived from different centers and pathways, so that a lesion which interrupts the pathway descending from the frontal lobe makes the voluntary movement disappear while the following movement may not be disturbed. However, many patients, although they are able to follow a moving object, lack the ability to make an "attraction movement"; that is, to turn the eyes toward an outlying object the image of which, situated in the periphery of the retina, attracts their attention.

Both kinds of movement belong to the so-called psycho-optic reflexes because, being produced by visual stimuli, they are performed more or less instinctively, so that one is justified in locating the origin of these movements in the occipital lobes. In spite of the fact that only the attraction movement can be lost while the following movement remains more or less intact, it is not necessary, in my opinion, to assume that they have separate centers and pathways. The patient, whose case was cited as an example of associated paralysis of vertical movements, was unable to overcome a prism of 10^{Δ}, base down or up, by elevation or depression of the visual lines, nor was he able to turn his eyes from the fixated point to an object, the image of which was situated 5 degrees above or below the retinal centers. But he accomplished vertical movements of 10 arc degrees and more when he was given prisms of gradually increasing strength, beginning with 1 or 2^{Δ}, or when he was induced to turn his eyes to an object which was situated near the fixed point, either above or below it, and from that object to another nearby, so that the eyes performed a sort of climbing along a vertical series of objects that were close together.

This behavior strongly suggests a comparison with fusion movements which are independent of the will. From testing the vertical duction power, for instance, it is known that one is unable, in the beginning, to overcome a prism of 5^{Δ} or more. But by beginning with a prism of 1^{Δ} or 2^{Δ} and gradually increasing the strength of the prism one can overcome from 8^{Δ} to 10^{Δ} by the appropriate vertical divergence. Such a fusion movement as well as the following movements in cases of associated paralysis may be explained in the same way. The nearer the image which attracts attention is situated to the fovea, the stronger is the motor effect that is produced. If a weak prism is placed, base out, before one eye, adduction takes place involuntarily, whereas a strong prism in the same position does not, as a rule, produce that movement. If the pathway descending from the occipital center is injured but not fully interrupted, the patient may be unable to perform an attraction movement of great extent, but he is able to make a small movement induced by the excitation of a paracentral retinal point. When the fixated object is moved slowly or the strength of the prism is increased little by little so that the retinal image of the fixated object moves from the fovea to a place in its proximate vicinity, a new small compensating movement results which becomes considerable in extent. This theory of mine must still be proved, but it takes into consideration all the clinical signs and symptoms, especially the fact that the following movement can be produced by moving the object across the field of fixation very slowly, or by turning the patient's head very gradually in the opposite direction. Unlike the sharp jerking of the head, such slow rotation causes no vestibular reflex movement.

According to the particulars which can be ascertained by the various methods of investigation, it may be possible to make

an approximate localization of the lesion causing the associated paralysis in an individual case. "Pseudo-ophthalmoplegia," so-called by Wernicke since he saw it as a partial manifestation of pseudobulbar paralysis, displays the following characteristics: The patient is unable to move his eyes at word of command, but moves them involuntarily in states of emotion or if he is interested in an object or in a sensory excitation originating from an object. The following movements can be produced provided the patient's attention is attracted to the moving object. The reflex movements of vestibular origin are undisturbed. In some of these cases the whole oculomotor apparatus, including the cortical centers, is uninjured, the lesion being "transcortical," injuring the connections between the frontal oculomotor centers and other parts of the cortex. Similar symptoms occur in diseases of the extrapyramidal system.

More frequently one encounters a second group of associated paralyses, characterized by the patient's inability not only to move the eyes in a certain direction either voluntarily or at word of command, but also to move them toward an object attracting his attention. The following movement and the reflex movements of the eyes can, however, be produced. In this group the lesion is to be localized below the cortex; probably the pathways descending from the frontal centers are injured not far above the nuclear region.

In a third group the paralyzed associated muscles react only to reflex (vestibular) stimulation; neither the voluntary and attraction movements nor the following movement can be produced. In cases of paralysis of the lateral movements the internal rectus muscles are able to perform the convergence movement; in cases of paralysis of the vertical movement the elevator muscles may be able to function in Bell's phenomenon. In such cases the lesion must be localized closely above the nuclei, the posterior longitudinal bundle being intact.

In a fourth group the paralyzed muscles do not respond to visual or other sensory stimuli, or to word of command, nor are they able to perform a following movement or, lastly, a reflex (vestibular) movement. In such cases either the posterior longitudinal bundle or the nuclei themselves must have been injured. The latter supposition is untenable in cases of paralysis of the lateral movements if the internal rectus muscles are able to produce a convergence movement and in cases of paralysis of the vertical movements, if Bell's phenomenon is undisturbed.

In the last group of associated paralyses there are not only symptoms of a supranuclear lesion, but also signs and symptoms indicating an injury of the nuclei, such as paralytic squint and diplopia and a variation in the behavior of the paralyzed muscles according to the mode of stimulation.

The cases of associated ocular paralysis caused by lesions within the cerebral hemispheres are usually unsuitable for precise investigation, partly because of the bad mental condition of the patients and partly because of the quick recovery of ocular movements if the patient does not die. It may be supposed that in some cases an examination would reveal almost the same symptoms as in cases of pseudobulbar paralysis, which have already been discussed as the first group of associated ocular paralyses.

Conjugate deviation

Conjugate deviation, which is found in most cases of a recent cerebral lesion, may be caused by a variety of circumstances. If an associated pair of muscles is paralyzed in consequence of a lesion

of the cortical center or of the path descending from it, the antagonistic pair of muscles ceases to receive its inhibitory innervation at the same time, because the excitatory and the inhibitory impulses to the agonists and antagonists, respectively, are derived from the same center and from the same pathway, so that a lesion of one not only causes paralysis of the agonists but also prevents relaxation of the antagonists. Besides the loss of inhibitory impulses, a stimulation of the antagonists may be caused by a lesion that extends to the other hemisphere. The different causes of conjugate deviation make it easy to understand that in cases of cortical lesions the deviation, as a rule, is greater than in cases of supranuclear paralysis of pontine origin and that it sometimes disappears within a few hours —as soon as the patient regains consciousness. Even if the conjugate deviation is essentially paralytic, it usually disappears rather quickly, probably because there are centers in both hemispheres for the parallel movement to the right and left, so that the center of the sound side soon begins to function vicariously. In the examples under discussion the patient's head is turned in the same direction as his eyes—that is to say, to the side of the lesion—except in those cases of hemiplegia which are characterized by contracture of the limbs. In these cases the eyes and the head are turned toward the affected extremities.

The accompanying table offers a comparison of the paralyses of lateral movements caused by pontine lesions and those caused by lesions in the hemispheres.

Paralyses of convergence

Since it is known that the internal rectus muscles can be deprived of the ability to coöperate with the external rectus muscles in lateral movements without interference with their convergence function, it seems obvious at first glance that the latter function can also be lost without prejudice to the former. It is not known where the convergence center is located. In view of the fact that convergence

Lesions of the Hemispheres	Pontine Lesions
1. Deviation in the first stage, regular and of considerable magnitude.	1. Deviation relatively rare and, as a rule, of small magnitude.
2. Deviation usually of short duration.	2. Deviation, if present, permanent.
3. Deviation toward the side of the lesion.	3. Deviation toward the opposite side.
4. Deviation frequently a symptom of stimulation.	4. Deviation usually a paralytic symptom, only rarely a stimulation symptom.
5. Head turned (as a regular symptom) in the same direction as the deviation of the eyes.	5. Abnormal position of the head not a typical symptom; if present, the head usually turned in the opposite direction to the deviation of the eyes.
6. Associated paralysis of the muscles for contralateral movement, usually slight and transient.	6. Associated paralysis in the direction of the lesion, nearly always severe and permanent.
7. Invariably symmetrical functional disturbance of the associated muscles.	7. Frequently asymmetrical paralysis of the associated muscles in consequence of the extension of the supranuclear lesion to the nucleus or the nuclei.
8. Paralysis of the extremities and of the facial nerve collateral with the associated eye-muscle paralysis.	8. Paralysis of the extremities, if present, opposite to the side of the eye-muscle paralysis; paralysis of the facial nerve, if present, usually collateral with the eye-muscle paraysis.
9. In lesions of both hemispheres all eye movements (including the vertical) restricted or impossible.	9. In pontine lesions of both sides, paralysis of side-to-side movements without disturbance of the vertical movements.

paralyses are frequently caused by lesions within the region of the corpora quadrigemina, it is presumed that a subcortical convergence center is located in that region; the isolated lesion of this center or of the pathway descending to the nuclei of both internal rectus muscles must produce the symptoms of a pure convergence paralysis. In such a case the patient's eyes are unable to converge, whereas the internal rectus muscles function normally when coöperating with the external rectus muscles in parallel movements. There is crossed diplopia of near objects, whereas objects at a distance of more than one meter are seen single provided the convergence paralysis is not complicated by an exophoria. Even a slight degree of exophoria causes insuperable crossed diplopia of distant objects if the convergence is abolished completely. The angle of deviation is the same when the patient looks straight forward or to either side, but it is increased not only when he looks at near objects but, as a rule, also when he looks up, and is decreased when he looks down, for the anatomic reasons mentioned previously. Variations of the signs and symptoms occur according to whether there is complete paralysis or only more or less weakness of the convergence function.

The convergence paralyses of organic origin are rare. Many of the cases published are no doubt instances of functional disturbances that are not always easy to distinguish from true organic paralyses. This difficulty is based on the exceptional position of the convergence among the ocular movements. Convergence does indeed belong to the fusion movements, but it is the only one that can also be performed voluntarily. If binocular single vision is lost or has never existed, as in cases of strabismus acquired in early childhood, the ability to converge is more or less diminished or is absent, thus proving that the fusion tendency is the most essential factor in producing convergence, whereas the voluntary impulse to look at a near point is of secondary importance in bringing convergence into play. In spite of equally good vision in either eye, convergence is frequently defective or absent, especially in myopic persons who do close work without glasses. Since they see distinctly at their *punctum remotum* they avoid the fusion effort which is not assisted by the accommodation impulse, and learn to suppress the retinal images of the nonfixating eye.

Lastly, an insufficiency of convergence as a true functional neurosis is encountered rather frequently not only in anemic and delicate persons or in patients convalescing after exhausting illnesses, but also as a symptom of general neurasthenia or hysteria. Conditions of this type are sometimes diagnosed wrongly as convergence paralysis because convergence cannot be produced by means of the usual methods. No convergence is obtained if the patient is ordered to fixate a near object, for instance, his own finger, or the fissure of Landolt's ophthalmodynamometer. But these tests do not offer reliable proof of the presence of a convergence paralysis unless it is ascertained that the patient has really been given the required impulse to look at the near object. This can be determined by observing his accommodation and pupils during the tests. Only if the pupils contract and the refraction increases according to the distance of the near object can one be certain that the deficiency of convergence is due to an organic lesion. I remember a patient who complained of a permanent crossed diplopia in near work after an accident. She was said to be an invalid after several oculists had submitted a diagnosis of convergence paralysis of traumatic origin. When her eyes were tested in the usual manner there was no

convergence. Since there was no accommodation and the pupils did not react in the tests I tried to ascertain whether the absence of cortical impulses was voluntary or involuntary. I asked the patient to tell me to which number the minute hand of my watch was pointing. She promptly produced the corresponding convergence, accommodation, and pupillary action. I have seen several similar cases in which the patient at first seemed unable to converge but could be induced to do so when he was tested with objects which attracted his attention and interest.

Another method suitable for deciding whether the lack of convergence is due to an organic lesion or is functional is the examination of the adduction power by means of prisms. In the case of convergence paralysis of organic origin crossed diplopia will arise as soon as a prism, base out, is held before one eye. In the case of functional deficiency of convergence binocular single vision will remain, and the eye behind the rotary prism will move in accordance with the increasing strength of the prism until the limit of the adduction range is passed.

To make sure that the lack of convergence is a true paralysis of organic origin, the following conditions must be fulfilled: 1. There must be definite symptoms of an organic intracranial disease. 2. The convergence paralysis must have occurred rather suddenly. 3. The signs and symptoms tested at various times and by various methods must, in a certain measure, be constant. 4. The accommodation and the convergence reaction of the pupils must be producible without the corresponding convergence.

If internal ophthalmoplegia is accompanied by convergence paralysis, a lesion of the nuclear region and possibly also of the supranuclear pathway descending from the convergence center is certain.

Divergence paralysis

Oculists are still at variance concerning divergence paralysis. Parinaud (1883) was the first to describe the signs and symptoms of divergence paralysis, and many authors have since confirmed his observations. Others, especially Berry and Alfred Graefe, have opposed the diagnosis, maintaining that the syndrome of so-called divergence paralysis should be explained in a different way.

The manifestations of a typical case of divergence paralysis include the following:

1. Homonymous diplopia, due to an abnormal convergence position, arises rather suddenly. It occurs for all objects beyond a certain distance, mostly beyond 10 to 20 inches.

2. The angle of squint being small or moderate, does not increase when the patient looks to the right or left; it will either remain the same as in the primary position of the eyes, or it will even decrease. It increases or, on the other hand, decreases when looking down or up, according to the normal anatomic conditions mentioned previously. This explains the habitual anomalous position of the head in some cases. The chin is depressed against the chest, so that by elevation of the visual lines convergence is transformed into parallelism, as has been demonstrated by photographs made of a similar case and discussed in the second paper in this series (fig. 9, p. 135, October, 1938).

3. When an object is brought nearer to the patient, the two images approach each other and are finally fused when the object is at a distance of from 10 to 15 inches. At this distance binocular single vision is maintained when looking to the right as well as to the left.

4. When the object is brought still nearer, insufficient convergence causes crossed diplopia.

5. Appropriate prisms, base out, give the patient binocular single vision, even of distant objects, in the whole field of fixation.

6. A restriction of the field of fixation is not found.

7. In repeated examinations at different times the angle of squint is found to be relatively constant.

From a theoretical point of view, the possibility of the occurrence of divergence paralysis must be conceded. On the other hand, I am convinced that in many cases a diagnosis of divergence paralysis is wrongly made. I have observed many patients with paralysis of one or both abducens nerves in whom typical symptoms were present at first, but the characteristic symptoms were gradually lost and a concomitant type of deviation developed so that it no longer increased, or, on the other hand, decreased when looking to the right and left. Sometimes this transformation may even occur within a few days. If such a paralysis is seen only in the later atypical stage, it is difficult to distinguish it from a divergence paralysis.

I have also observed patients with symptoms apparently typical of this kind of paralysis, caused by a slight convergence spasm. I remember one patient with a homonymous diplopia that had arisen four months previously. According to the report of his physician, intervals without diplopia alternated with periods during which the original diplopia was observed. The patient was extremely irritable and had been dismissed from military service on account of epileptic fits. In the first examination I found an abnormal convergence of 6 degrees when the patient's eyes were directed to a distant object. This decreased slightly when he looked to the left or to the right or up, increasing only when he looked down. When the object was brought closer, to a distance of 15 inches, binocular single vision was obtained in the whole field of fixation, whereas crossed diplopia arose for nearer objects. Prisms of 5^{Δ} placed, base out, before each eye gave binocular single vision also for distant objects. All these symptoms coincided completely with those of typical divergence paralysis. Only repeated examinations brought discrepancies to light. When the patient opened his eyes after he had closed them for a fraction of a minute, crossed diplopia corresponding to a divergence of 2 degrees occurred, but only for a few seconds. Then the two images approached one another, fused and separated again, this time, however, as homonymous images, as the result of the gradual increase—up to 6 degrees—of convergence. Such behavior is just as difficult to reconcile with divergence paralysis as is the fact that the patient, who primarily required a prism of 5^{Δ}, base out, before each eye to obtain binocular single vision, was able to maintain it even when the strength of the prisms was diminished. He was able to maintain it even when the prism had an abducting effect, so that a divergence of 1 arc degree was produced. This, however, lasted only for a few seconds, after which his eyes went back to the usual convergent position. Thus the true nature of the case was disclosed. It was not, as had been previously diagnosed, a case of divergence paralysis but one of slight convergence spasm occasionally met with in highly neurotic persons such as our patient. Objection could be made to the diagnosis of convergence spasm since the patient displayed convergence insufficiency at reading distance, whereas in a case of spasm one would expect an increase of convergence. But it is by no means unusual to find inability to transform convergence into parallelism in combination with a weakness of the convergence innervation—a peculiarity

seen especially in neurasthenia, an important characteristic of which is the combination of increased irritability and abnormal exhaustibility.

A third anomaly might perhaps be mistaken for a divergence paralysis. If the fusion faculty is destroyed by a physical or psychic shock, an esophoria which up to that time has been unnoticed may become manifest and display symptoms similar to those of a divergence paralysis. As a rule, however, a thorough examination of the range of duction will show absence not only of divergence but also of other fusion movements.

Although it must be admitted that the differential diagnosis in many cases is extremely difficult, sometimes even impossible, I am sure that divergence innervation exists and that I have seen instances of a true divergence paralysis which not only presented the typical manifestations of the anomaly but, and this is of decisive importance, also changed rather suddenly into an equally typical case of abducens-nerve paralysis. Such a development is proof of an organic lesion, localized at first near the intact abducens nucleus but later extending to and finally injuring the nucleus itself.

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TONOMETRY AND UNUSUAL CASES OF GLAUCOMA

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Our knowledge of glaucoma is still incomplete and based too much on the examination of eyes with absolute glaucoma that have been removed for pain. The tonometer, giving a mathematical statement of the hardness of the eyeball, is too much trusted as a final authority. A diagnosis should be like a court decision, based on a knowledge and right evaluation of all the facts bearing on the case. A first, provisional diagnosis may be considered as a hypothesis to help arrange the facts, so that apparently opposing facts may be compared and an estimate formed of their relative importance. But the final diagnosis should be based upon a consideration of all the facts. Often it must wait until the case has run its course; and, for some conditions, this is impossible. Not all the facts bearing upon the diagnosis are obtainable.

When a known laboratory procedure is carried over into clinical medicine, it may bias our judgment so as to disturb more than help diagnosis. When the ophthalmometer was applied to the clinical study of astigmatism, it was supposed to be an infallible guide that made cycloplegia unnecessary. Then a correction of 0.50 or 0.75 D. was found necessary for the prescribing of cylinders. Now it is known that the astigmatism of the crystalline lens changes with age, and the ophthalmometer is found to be of little practical value for the measurement of astigmatism after middle life.

Similar revisions of our estimates of values have been necessary for the Wassermann reaction, and for the various tuberculin tests. They must also be made for evidence given by the tonometer as to intraocular pressure and glaucoma. Our understanding of glaucoma has been based on the examination of eyes destroyed by the disease. It needs to be corrected by histories of cases in which destruction of vision did not occur. Very few of these cases are found recorded in the literature. But they occur, and the reports of such cases would give us a better understanding of the real tendencies and results of glaucoma.

At the Pan-American Medical Congress, in his helpful remarks on glaucoma, Dr. Edward C. Ellett stated that we know glaucoma untreated, or inefficiently treated, goes on to blindness. The general opinion is that blindness is inevitable, unless a successful operation checks the progress of the disease. The following cases show that such may not be the result.

Case 1. C.D.L., aged 56 years, stood for many hours by her husband's death bed, exposed to severe cold, with the wind blowing on her right eye. That night she suffered terrible pain in the right eye and head; and after that she suffered from neuralgia, worse in the right eye. She was sent to me after three weeks, with the diagnosis of "grippe." The eye was hyperemic with slight pericorneal redness; the pupil ovoid, 5 mm. in diameter. The cornea was hazy, so that fundus details could not be seen; tension +2; vision, the ability to detect moving objects in the temporal field.

In the left eye the pupil was 3 mm. in size, the tension normal, the fundus normal, and vision 4/4. Operation on the right eye was urged, and eserine 1 to 2000 solution prescribed. Next day the pain was relieved, and did not return. In three weeks the cornea was clear, and the optic disc showed a slight cup, 1 diopter,

to the abrupt edge. In three months the patient had another attack, with pain, tension +2, and aching for two days. After more than a year she had continued free from any other attacks.

Case 2. Mrs. D.J. began wearing glasses at the age of 37 years, for near work only. At the age of 63 she needed for distance +3.50 D. sph., and for near +5.50 D. each, but did not wear glasses constantly. She now found the sight very poor in the left eye, 4/45 eccentric, and it felt full. There was pain around it. Pupils both were circular, 4 mm. in diameter. Tension was +1. After she had become very tired one day the eye became congested and very painful that night. Eserine 1 to 400 contracted the pupil and relieved the pain. But three days later it was extremely painful with tension of +3.

Posterior sclerectomy was done, 8 mm. back from the temporal limbus, and the anterior chamber became two thirds filled with blood. One week later pain returned, the pupil dilated to 5 mm. There was a bleb over the scleral incision. Tension was +2. These conditions continued over two weeks. Then iridectomy was done upward, and the pillars of the iris were drawn up into the subconjunctival space and caught in the angles of the scleral wound. This gave relief from pain, tension became −1, the eye comfortable. This condition continued to her death at the age of 75. The right eye continued normal, with vision of 1 +.

Priestley Smith defines glaucoma "as an excess of pressure within the eye, plus the causes and consequences of that excess." But there are other conditions, some yet unknown, that are needed to make the dreaded disease glaucoma. We may have excess of pressure apart from glaucoma; and we may have characteristic changes of the eye, atrophy of the optic nerve, and blindness without discovering at any time an excess of intraocular pressure. So firmly fixed is the idea that increased intraocular pressure means glaucoma that serious errors are based on a tonometric reading. A few cases that have been followed up, for a number of years afterwards, show conclusively that high tension may be present for a time without any danger of glaucoma.

Case 3. Miss J.E., age 31 years, whose father had lost one eye from glaucoma, had worn glasses for aching of the eyes when at school. With the Gradle-Schiötz tonometer the intraocular pressure measured in each eye 35 mm. Hg. The fields of vision and the optic discs were normal. With correcting glasses vision was 4/3 partly in each eye. She was given pilocarpine, 1 percent solution, to use twice a day. This was discontinued within two years. At the age of 38 years her tension was 30 mm. in each eye, vision 1.2 in each, and the fundus was normal. Correcting glasses were given, and 1.25 D. sph. added for reading. She seems to have continued free from any indication of glaucoma.

Republic Building.

FREQUENCY OF BLINKING AS A CLINICAL CRITERION OF EASE OF SEEING

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It is generally assumed that visibility[1] and ease of seeing are closely related and that objects of the highest visibility are seen with the least visual effort. The latter is here defined as a subjective experience of strain which accompanies voluntary action. Thus measurements of visibility are useful in appraising the effectiveness of various controllable aids to seeing. However, if an increase in visibility is accompanied by functional changes such as an alteration in the functioning of the mechanisms of accommodation and convergence, it cannot be assumed *a priori* that an enhancement of visibility results in a decrease in the effort of seeing. For example, it it is readily demonstrable that the placing of a low-power concave lens before an emmetropic eye results in a higher degree of visibility for distance vision.[2] However, such an addition to the refractive systems of the eyes usually cannot be worn with comfort, particularly in the performance of near-vision tasks. Thus visibility, as a diagnostic criterion in ophthalmology, is not necessarily of primary importance from the viewpoint of ease of seeing, as is qualitatively well known. In general, it is the purpose of the present paper to discuss the periodic movements of the eyelids as a criterion of ease of seeing, and as a clinical method for appraising ocular comfort.

THEORETICAL CONSIDERATIONS

A consideration of the possible physiological causes of involuntary blinking leads rather directly to the theory that this activity of the eyelids is related to the degree of "tension" or state of "fatigue" of the subject which exists at the time. It has also been observed that the frequency of blinking is remarkably constant for the individual under constant experimental conditions.[3] Obviously, the latter characteristic suggests the possibility that the frequency of blinking may serve as a practical criterion of the visual effort expended in seeing under different experimental conditions. Thus it may be possible to determine the relative degree of ocular comfort afforded by different ophthalmic corrections worn by the patient while the latter performs a critical visual task such as reading.

In briefly reviewing some of the theories related to the phenomenon of blinking, the terse statement of Duke-Elder[4] is perhaps the most enlightening: "The causation of the movements of blinking has excited little interest. It used to be tacitly accepted that it was a reflex initiated through the fifth nerve to keep the cornea moist and to wash it clear of foreign particles. This, however, is not the case although the movements are increased by peripheral irritation." More specifically, the researches of Ponder and Kennedy[3] suggest that the normal and periodic movements of blinking are not necessarily dependent upon impulses in the second, third, fourth, fifth, or sixth cranial nerves, and that they are also not dependent on afferent impulses arising from retina, cornea, conjunctiva, or extrinsic muscles. Thus, these investigators conclude that the eyelid movements are not of a reflex character, in the ordinary sense of the word, since there appears to be no afferent path the destruction of which causes blinking to cease.

* From the Lighting Research Laboratory, General Electric Company.

However, Adler[5] questions the validity of this conclusion on the basis that the functions of all of these nerves were not simultaneously excluded.

Ponder and Kennedy summarize their viewpoint by stating that "the rate of blinking is closely related to the mental tension of the subject at the time, and that in all probability the movements constitute a kind of relief mechanism, whereby nervous energy, otherwise unutilized, passes into a highly facilitated path." They further conclude that "all that is necessary to occasion a change in the rate of blinking is a change in the degree of attention* of the subject."

In general, these conclusions pertaining to the physiological significance of blinking are substantiated and extended empirically by a number of researches conducted by the authors.[6] Our results also suggest that an increase in the so-called normal rate of blinking is due, at least in part, to factors associated with fatigue. According to Blount,[7] one of the reasons for blinking is to allow alteration to take place in the tension of the ocular muscles and thus eliminate early fatigue. The investigations of Miles[8] indicate that the movements of blinking are associated with an upward and inward movement of the cornea of 10 to 15 degrees which is accomplished in somewhat less time than is required for the complete lid movement. If the theory of Blount is correct, it follows that the movements of the eyeball on blinking are effective in minimizing the development of muscular fatigue as well as in protecting the cornea from distortion by the tightly fitting tarsal edges of the lids and in serving other important purposes. Thus it appears that attention, effort, and fatigue are to be considered as factors which influence the frequency of the periodic movements of blinking. In fact, Litinsky[9] has proposed the recording of blinking as a method of studying ocular fatigue in school children while reading. This possibility heretofore has not been studied extensively. In general, previous researches on blinking have been largely devoted to the study of conditioned reflexes rather than from the present viewpoint of a criterion for appraising the effectiveness of various aids to seeing.

*Attention (behavioral concept): An adjustment of the sensory apparatus which facilitates optimal excitation by a specific stimulus or complexity of stimuli, and which inhibits the action of all others.

Empirical considerations

It is axiomatic that the degree of fatigue induced by the performance of work increases as the task is prolonged. Thus the frequency of blinking should increase as a critical visual task is prolonged, if blinking is associated with effort and fatigue. This assumption has been experimentally confirmed by the authors by observing the frequency of blinking during the first and last five-minute periods of an hour of continuous reading. In general, our experimental conditions involved the reading of interesting material under three different levels of illumination by a group of 11 adult subjects possesssing normal or near-normal vision. The results are summarized in table 1.

It will be noted that the frequency of blinking is higher during the last five-minute period of reading than it is during the first periods under all illuminations. The same result was invariably obtained by each of the 11 subjects. The statistical data of table 1 also indicate that the alterations in the frequency of blinking are highly significant with respect to their corresponding probable errors. Furthermore, it will be noted that the rate of blinking during the last five-minute period decreases as the task of reading is made

TABLE 1

THE NUMBER OF BLINKS OCCURRING DURING THE FIRST AND LAST FIVE-MINUTE PERIODS OF AN HOUR OF READING. THE VALUES REPRESENT THE GEOMETRIC MEANS OF THE DATA OBTAINED FROM ELEVEN SUBJECTS.

	1 Foot-candle		10 Foot-candles		100 Foot-candles	
	First	Last	First	Last	First	Last
No. of blinks.....	35	60	35	46	36	39
Percent increase.....	71.5±5		31.4±3		8.3±1	

easier by higher levels of illumination.[10] This is a highly significant fact, since it has been shown[3] that mere photometric stimulation does not materially alter the normal frequency of blinking except for a few rapid blinks which may occur immediately after a sudden change in illumination or brightness. In fact, the so-called normal frequency of blinking is about the same in the dark as it is in the light, other conditions being constant. Thus it appears from these data that the frequency of blinking is definitely correlated with both the duration and the severity of the visual task. Similar results have been obtained under various experimental conditions which are known to be favorable or unfavorable for ease in seeing. Some of these results are briefly summarized in table 2.

The data of tables 1 and 2 show that an increase in the frequency of blinking invariably occurs when the conditions for seeing are made more unfavorable. It will be obvious from these brief descriptions of the visual tasks that the more unfavorable conditions involve (a) the fatiguing effects of prolonged voluntary activity of the extrinsic muscles; (b) the distraction of a bright peripheral image during reading; (c) the fixation and recognition of very small details; (d) an unusual relationship between accommodation and convergence due to the red background of the reading matter; and (e) perceptual and fixational difficulties arising from closely spaced lines of print. Hence it follows that the rate of blinking is intimately related to various and complex psychophysiological factors involved in seeing, thus empirically confirming the conclusions of Ponder and Kennedy.[3] Furthermore, it appears from these data that the frequency of

TABLE 2

DATA OBTAINED DURING EXPERIMENTAL PERIODS OF FIVE MINUTES EACH

Visual Situation	Relative Rates of Blinking	
a. Performing a task requiring rapid alternate fixation of test objects separated laterally by 30 degrees*	First 5 min. Second 5 min. Third 5 min.	100 146 171
b. Reading with and without glare. The glare-source was a bare 50-watt lamp placed 1 meter from the eyes and 20 degrees above the the line of vision while reading*	Without glare With glare	100 156
c. Reading types of different sizes under 10 foot-candles*	12-point type 6-point type	100 148
d. Reading 10-point type on white and fairly saturated red paper† (reference 11)	White paper Red paper	100 118
e. Reading 10-point type set solid and with 3 points of leading‡ (reference 12)	3-point leaded Solid-set	100 120

* Average of 18 subjects. † Average of 20 subjects. ‡ Average of 30 subjects.

blinking is an extremely sensitive criterion of ease of seeing, since rather large differences in frequency are obtained between visual conditions which are commonly encountered in practice. Therefore, we have used it as a criterion for appraising ocular strain and fatigue arising from uncorrected or improperly corrected refractive errors of the human eye.

Considering the subjects as a group, it will be noted that the minimum frequency of blinking occurred with plano lenses in addition to the usual corrections, if any. Quantitatively, the frequency of blinking was increased about 42 percent by the addition of the convex spheres and about 37 percent for the concave spheres during a five-minute period of reading. This is an indication of the sensitivity of the criterion, since these changes in the frequency of blinking were occasioned by a change of only 0.50 diopter. It is also significant that the highest rate of blinking was not obtained with the plano lenses in any one of the 30 cases studied. This fact represents additional evidence that the observed differences in blinking are due to differences in ocular comfort rather than to uncontrolled factors or chance. In all cases, the subjects were instructed to read at their normal or usual rates and, almost without exception, they were unaware of the fact that their blinking was being observed. Thus it seems reasonable to assume from these data that the criterion of blinking is capable

TABLE 3

THE FREQUENCY OF THE REFLEX BLINK AS A CRITERION FOR DETERMINING THE EFFICACY OF OPHTHALMIC CORRECTIONS PRESCRIBED ACCORDING TO THE USUAL TECHNIQUES. THESE DATA DENOTE THE NUMBER OF BLINKS OCCURRING DURING FIVE-MINUTE PERIODS OF READING WHILE WEARING CORRECTIONS OF +.50 DIOPTER AND −.50 DIOPTER, RESPECTIVELY, IN ADDITION TO THE CORRECTIONS USUALLY WORN.

Subject	Frequency of Blinking			Subject	Frequency of Blinking		
	+.50	0	−.50		+.50	0	−.50
1	38	27	40	16	60	36	48
2*	30	22	30	17	35	26	31
3*	77	64	83	18	25	14	19
4	28	17	21	19*	40	30	52
5	93	70	82	20*	28	27	37
6*	16	12	14	21*	17	13	20
7	17	12	12	22*	112	78	92
8	40	20	33	23*	49	36	40
9	38	28	46	24*	25	14	18
10	7	10	12	25	60	24	39
11*	18	10	16	26*	6	8	10
12*	30	24	30	27*	43	33	100
13*	9	6	9	28	16	5	12
14*	25	14	22	29	42	24	34
15*	33	25	25	30*	57	48	56
* Correction worn				Arithmetic mean	37.1	25.9	36.1

BLINKING AS AN OPHTHALMOLOGICAL CRITERION

The number of blinks occurring during five-minute periods of reading is given in table 3 for 30 subjects wearing (1) plus 0.50-diopter spheres, (2) plano lenses, and (3) minus 0.50-diopter spheres in addition to the usual correction, if any. Obviously, these additional corrections resulted in either blurring the retinal images or dissociating the normal relationship between accommodation and convergence, if it is assumed that emmetropia prevailed with the plano lenses. All of the subjects were adults and, insofar as is known, all were free from pathological conditions.

of indicating the proper refraction, at least with respect to the spherical component, upon the basis of comfort in seeing.

An analysis of these data with respect to individual cases indicates errors in refraction in at least 5 of the 30 cases studied. Subjects 7, 10, 15, 20, and 26 are included in this group. Among the latter it will be noted that three of these subjects do not wear glasses. It will also be noted in these six cases that the indicated errors are on both the plus and minus sides of "perfect" correction. Our interpretation of these data, for a few typical cases, follows:

Subject 2. It is apparent that the glasses worn by this subject provide maximal comfort in view of the symmetrical relationship between the frequency of blinking and the additional spherical power.

Subject 27. The sharp rise in the frequency of blinking with the addition of 0.50 diopter of minus power indicates the seriousness of overcorrecting this subject with minus lenses. Obviously, a correlation of these results with muscle-balance findings would add to the significance of the former.

Subject 25. This case is the reverse of that of Subject 27 and indicates the ocular discomfort which would result from overcorrecting with plus lenses.

Subject 6. Since an addition of 0.50 diopter of either plus or minus power produces but little change in the frequency of blinking, a slight error in correcting this subject appears to be correspondingly less serious.

The simplicity and ease with which these data may be obtained and the significance of the criterion as a measure of ocular comfort suggests the possible usefulness of this method in clinical practice. For example, this criterion might be of value in prescribing corrections in the following situations:

(a) In cases involving a compromise between over and under corrections as these are associated with the accommodative-convergence relationship.
(b) In cases involving significantly different findings by subjective and objective techniques of refraction.
(c) In cases free from refractive errors which involve an adductive insufficiency or excess.
(d) In cases involving corrections in anisometropia.
(e) In determining the advisability of fuil corrections in myopia.
(f) In determining the benefit derived from tinted lenses.
(g) In determining the benefit derived from iseikonic lenses.

In general, this technique seems to be applicable to those cases in which an objective and quantitative indication of ocular comfort would be of value. For example, it seems reasonable to assume that this objective criterion would be more reliable than the introspective reports of children with respect to ocular comfort; and in any case, it should be of value in prognosis. However, it is recognized that any criterion of ocular comfort applied immediately after a given change in refraction will not necessarily appraise the ultimate merit of the change since some adjustment or compensation to the new corrections may be required. On the other hand, this deficiency or inadequacy is not unique to the factor of ocular comfort as a phase of refraction.

Experimental techniques

The experimental data presented in tables 1, 2, and 3 involve, with one exception, the frequency of blinking while reading. However, it is conceivable that

other activities may be suitable for clinical purposes in certain cases. For example, the data of Telford and Thompson[13] indicate an average of 44.5 and 14.4 blinks during a five-minute period of conversation and reading, respectively, for a group of 36 subjects. These investigators suggest that the decreased blinking found during reading is not due to the mental activity involved, but possibly to several other factors; such as, the visual fixation and eye-movements involved in reading. The latter may increase or decrease the so-called normal rate of blinking. In view of these results, it is possible that the rate of blinking could be observed during conversation and while the patient was wearing the different corrections being considered from the basis of ocular comfort. It is also possible that the higher frequency of blinking during conversation would shorten the time required to obtain reliable data. An obvious objection to the latter technique is the fact that information on comfort at the near-point would not be obtained. Therefore, it seems preferable to utilize unfavorable visual conditions, such as low levels of illumination, to increase the frequency of blinking for the purpose of obtaining greater precision where necessary.

The frequency of blinking may be determined either by direct visual observation or automatically through the amplification and recording of the action-currents arising during the interval of blinking. One advantage of the latter method is that longer periods of reading may be utilized. In general, we prefer the visual method, aided by a hand counter, in cases in which the periods of measurement are brief. Obviously, the duration of the experimental period depends upon the differences in visual difficulty among the situations to be appraised. In general, our experiences indicate that a period of five minutes is adequate, although in some cases it is advisable to repeat the series of measurements and use the mean values for interpretation.

Nela Park.

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FUSO-SPIROCHETAL INFECTION OF THE EYE AND ORBIT*

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Ocular inflammation resulting from infection with Borrelia vincentii and Fusiformis dentium is rare. Dunnington and Khorazo,[1] in a recent survey of the literature, collected 13 cases. In most instances other pathogenic bacteria were present in the exudate, making it difficult to evaluate the rôle played by Vincent's organisms. Gifford[2] has pointed out that these

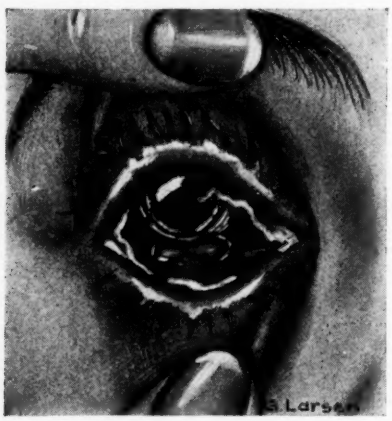


Fig. 1 (Walker). Ulcer of conjunctiva and sclera.

bacteria probably are normal inhabitants of many mouths and that they may take advantage of conditions of lowered resistance or neglect of cleanliness, either to produce disease or to live as saprophytes on diseased tissues. Another case which tends to bear out this assumption is presented.

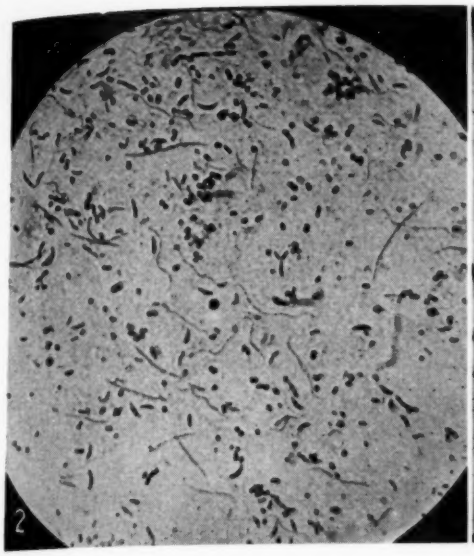
A 47-year-old, white woman with arthritis and secondary anemia was admitted to the University Hospital on August 28, 1937, complaining of a discharging tooth socket and swelling and redness of the eyelids of the right side. The tooth socket had been draining since the extraction of a right, upper, molar tooth, three weeks previously. One week later redness and swelling of the eyelids developed and gradually increased until the day of her admission.

Examination revealed an anemic, emaciated, white woman confined to bed with far-advanced generalized atrophic arthritis. The mucous membranes of the mouth appeared healthy, but in the socket of the first, right, upper, molar tooth was a fistulous tract leading into the antrum. A probe passed through this fistula was covered with foul smelling, purulent discharge.

The lids of the right eye were reddened and almost closed as a result of edema and swelling. A profuse, yellowish-white, foul-smelling discharge exuded from the palpebral fissure. There was moderate proptosis, and the movements of the eyeball were restricted. Both the upper and the lower palpebral conjunctivae were covered with pseudomembranes which upon removal revealed a marked papillary hypertrophy. The entire conjunctiva was diffusely reddened, and the bulbar conjunctiva was chemotic. The pupil measured 3.5 mm. in diameter and did not react to light. The anterior segment of the eye appeared to be normal, the media were clear, and no pathology was seen in the fundus. The left eye was normal.

Smears from the conjunctiva and from the oral fistula, stained by the Gram technique, showed large numbers of spiral and fusiform organisms. Gram-positive rods and Gram-positive cocci also were present.

* From the Department of Ophthalmology, College of Medicine, State University of Iowa. Part of a study being conducted under a grant from the John and Mary R. Markle Foundation.



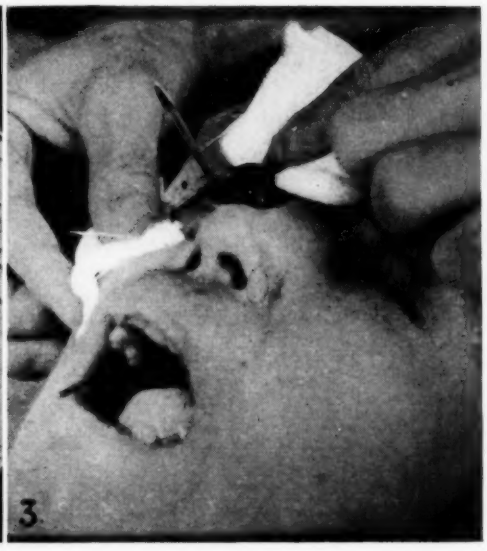


Fig. 2. (Walker). Direct smear from conjunctiva, showing fusiform bacilli, spiral organisms, and cocci. Gram stain.

Fig. 3 (Walker). Probe passed through orbit, antrum, and tooth socket.

Forty-eight hours after admission a perforating ulcer of the conjunctiva and sclera had developed a few millimeters below the lower limbus; through this ulcer protruded a small strand of necrotic tissue (fig. 1). The cornea retained its normal luster, but the anterior chamber was deep, and the pupil widely dilated. Pressure on the soft globe caused distortion of the iris. The vitreous contained large yellowish-white opacities that obscured the fundus. Vision was reduced to light perception.

Smears taken from the area of the scleral perforation showed great numbers of fusiform and spiral bacteria (fig. 2).

The following day, while cleansing the mouth, the fluid regurgitated through the antra-oral fistula and into the conjunctival sac. At this time there was a yellow reflex from the vitreous and from the cornea, which shortly thereafter became opaque and was sloughed. On the ninth day the eye appeared as a purulent necrotic mass and was lifted from the socket with forceps. A probe was passed easily from the orbit, through a dehiscence in the anterior portion of the infra-orbital plate, into the antrum and out through the tooth socket into the mouth (fig. 3).

Nineteen days after admission, the patient developed fever, headache, photophobia, delirium, and stiff neck. The spinal fluid contained 1140 cells per cubic millimeter and Gram-positive cocci were demonstrated in a centrifuged specimen. Some clinical improvement was noted following intra-thecal prontosil therapy, but two days later the patient died very suddenly.

At necropsy there was a basal meningitis which appeared to have extended from the orbit along the optic nerve. The optic nerve was necrotic and covered with a grayish-white purulent exudate. Gross extension of the inflammation through bone was not demonstrated. The immediate cause of death was found to be a large subdural hemorrhage arising from a ruptured aneurysm of the left internal carotid just proximal to its bifurcation.

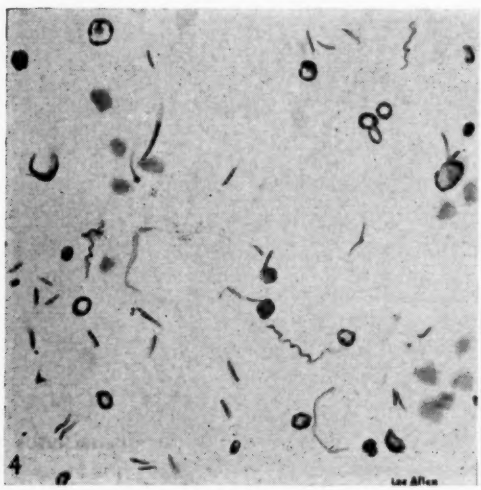
The right sphenoid sinus contained a thick muco-purulent exudate.

Therapy: Irrigations of 1-percent sodium perborate and instillations of neoarsphenamine suspended in glycerine were used locally after fusiform and spiral bacteria were demonstrated in smears. Three injections of 0.3 gm. of neoarsphenamine were given intravenously. Intrathecal injections of sulfanilamide were given after the onset of meningitis.

Laboratory findings: Smears from the antra-oral fistula, conjunctiva, and area of the scleral perforation showed large numbers of fusiform and spiral bacteria with the morphology of Vincent's organisms. Gram-positive rods with the morphology of corynebacteria and Gram-positive cocci also were present. Smears taken at frequent intervals from the conjunctival discharge showed the Gram-positive cocci to increase in number as the disease progressed. After the onset of meningitis, smears of centrifuged spinal fluid showed the presence of Gram-positive cocci, but fusiform and spiral organisms were not demonstrated.

Repeated attempts were made to cultivate Vincent's organisms aerobically and anaerobically on plain and enriched media, without success. However, anaerobic beta hemolytic streptococci were cultured from the conjunctiva, spinal fluid, and the subdural blood clot.

Sections of the ruptured internal carotid artery were stained by the Giemsa method and by Verhoeff's technique,[3] and large numbers of cocci as well as fusiform and spiral bacteria were demonstrated in the exudate surrounding the ruptured artery (figs. 4 and 5).



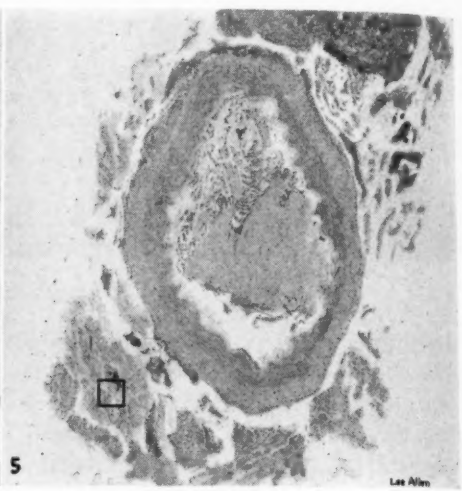


Fig. 4 (Walker). Organisms in exudate surrounding carotid artery.
Fig. 5 (Walker). Relative location from which figure 4 was drawn.

Discussion

On the basis of morphology and staining reactions it seems likely that Vincent's symbiotic organisms were present in this case. It is impossible to evaluate their etiologic rôle because of the presence of anaerobic beta hemolytic streptococci. Possibly the poor general condition and lowered power of resistance rendered the patient susceptible to organisms ordinarily saprophytic.

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ANISEIKONIA

A STUDY OF 836 PATIENTS EXAMINED WITH THE OPHTHALMO-EIKONOMETER*

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Because aniseikonia is receiving more consideration as a possible source of asthenopia in some of our patients, we believed it to be profitable to study the results of the examinations of patients suspected of having aniseikonia who were observed in the New York Eye and Ear Infirmary and in our own private practice during the past three years.

In this article we will outline briefly some points in the history of aniseikonia and analyze the statistical data compiled from the examination of 836 patients, 125 of whom were from our private practice, in the hope of formulating an opinion in regard to the clinical value of correcting aniseikonia. Although the number of cases in each group of private patients is comparatively small, the entire series has been thoroughly studied and examined, and the majority were treated for asthenopia and other symptoms by the most approved methods before aniseikonic lenses were prescribed. We appreciate fully the necessity for making a conservative evaluation of any clinical and therapeutic measure because of the lack of satisfactory criteria and controls from which to draw definite conclusions.

The term "aniseikonia," derived from the Greek ἄνισος, unequal + εἰκων, image, was used by Ames,[1] at the suggestion of Lancaster, to describe that condition of the eyes in which there is a difference in the size or shape of ocular images (retinal images as interpreted by their corresponding brain centers).

Aniseikonia is of two principal types: (1) Overall difference, in which one image is larger than the other in all meridians, and (2) meridional difference, in which one image is larger than the other in one meridian. Combinations of the two forms may also occur. If ocular images are markedly unequal in size or shape, there may be a disturbance of binocular vision which may or may not be apparent to the patient. However, because the effects may become manifest through the nervous system, the condition has significance not only for the ophthal-

* From the Department of Research, New York Eye and Ear Infirmary. Aided by a grant from the Ophthalmological Foundation, Inc. Presented at the Seventy-fourth Annual Meeting of the American Ophthalmological Society, at San Francisco, California, June 9-11, 1938.

mologist, but also for the neurologist and the general physician.

History

The inequality of images formed on the retinas was discussed by Donders in 1864 and in 1875 by Wadsworth,[2] who produced inequality of images by holding a concave cylinder with vertical axis before one eye. Eight years later, in a paper on the apparent curvature of surface produced by prisms, Wadsworth[3] described distortion of images by prisms. He pointed out that the refraction of a prism when its rays diverge from a point other than its original source causes a flat surface to appear curved; if the prisms are turned with the bases in it is convex, and if the bases are directed temporally it is concave.

In 1888 Culbertson[4] described a phenomenon similar to that reported by Wadsworth in 1875. In 1889 Lippincott[5] described the effect of plus and minus spheres and cylinders placed before the eyes upon the objects observed by the subject. He stressed the fact that such distortions occurred in nearly all cases of anisometropia, and could be eliminated by the constant use of lenses.

In the same year Green[6] published an article, "On certain stereoscopical illusions evoked by prismatic and cylindrical spectacle-glasses." His illustrations of these illusions are of assistance in understanding the basic principles of aniseikonia. He also pointed out the importance of correcting unequal images by wearing glasses constantly.

In 1899 Risley[7] discussed "The significance of certain rare forms of ametropia," and reported cases that were relieved by means of lenses. In the same year Jackson[8] described the management of cases of high anisometropia.

In 1890 Theobald[9] reported cases of squint and esophoria due to anisometropia that were cured by the wearing of glasses.

In 1901 Alexander Duane[10] concluded that, in the large majority of cases of anisometropia, full correction could be applied with success, provided the patient was warned that it might take from one to two weeks before he became accustomed to the glasses, and that during this period he must wear the lenses constantly. Duane believed that the causes of temporary or permanent discomfort in wearing glasses were: (a) The strength of the lens *per se;* (b) the unequal prismatic action of the unequally strong glasses; or (c) the presence of muscular deviation producing diplopia. Duane was also of the opinion that the statement that glasses for the correction of anisometropia give rise to trouble by producing retinal images of a different size, was probably fallacious. The proportion of cases of anisometropia with squint, according to Duane, was high.

Anisometropia was also discussed by Delogé[11] in 1906. In 1914 Erggelet[12] stated that absolute equality of retinal images could not be obtained from the correction of anisometropia. Erggelet also stated that children whose anisometropia is corrected learn to adjust more readily than do adults who have previously acquired and practiced relations of retinal correspondence in the presence of aniseikonia and who now are suddenly forced to adjust their vision to anisometropic correction.

In 1927 Cattaneo[13] pointed out that the size of retinal images could be equalized with the proper correction of ametropia and anisometropia, by placing the lens 15 mm. from the cornea.

The consideration of differences in the size and shape of the ocular images has assumed greater clinical importance during the past few years because of the

splendid work of Ames and his associates in the Department of Research in Physiologic Optics in the Dartmouth Eye Institute.[14-24] The Dartmouth group has developed methods of measuring differences in size of the ocular images, studied variations in tolerance to differences in size of images, and ground lenses for correcting these differences. Our patients have been tested by the method developed at the Dartmouth Eye Institute.

In 1935 Hughes[25] concluded that equalization of the size and shape of the visual images brings relief from the annoying symptoms dependent on their asymmetry in a large proportion (about 80 percent) of cases. Three cases of defective fusion with amblyopia ex anopsia (one with convergent strabismus) and a great inequality in the size and shape of the visual images were reported by Hughes.

In 1936 Hughes[26] reported that of 357 cases examined for aniseikonia, 65.8 percent were positive. Only 191 patients received the iseikonic lenses. Complete relief was obtained in 46.6 percent; marked relief in 26.2 percent, and slight relief in 2.7 percent. No relief followed in 24.5 percent. Hughes believes that the correction of aniseikonia may be a means of helping approximately 75 percent of the difficult refraction cases in which symptoms are not relieved by the ordinary methods of refraction.

In 1937 Hughes[27] reported that in 14 cases with aniseikonia 10 patients obtained relief by wearing iseikonic zero-power lenses designed to correct the aniseikonia present. He believed that it had been shown that the presence of aniseikonia is independent of any refractive error. Later in 1937[28] he discussed aniseikonia with no refractive error.

In 1935 Doane[29] stated that aniseikonia exists with emmetropia, and that while the larger number of cases may be found with anisometropia, the condition does exist with equal ametropia. Of the 370 patients he examined for aniseikonia with the ophthalmo-eikonometer, 70 percent showed aniseikonia.

In a later report by Doane[30] of 94 patients who wore iseikonic lenses for at least one year, 68 reported definite relief and 26 reported partial relief. Doane also believed that it required a long time to break down the aversion to spectacles, and that the same is true of iseikonic lenses.

In Hardy's[31] series of 34 patients for whom iseikonic lenses were indicated either for relief of symptoms or for aniseikonia or for both, 41 percent were improved after wearing the glasses and 41 percent were unimproved. In one patient the effect was not stated, and 14.7 percent were not given lenses.

In 1932 Madigan[22] and Carlton reported that in approximately 20 percent of 96 cases, correction of size differences apparently brought complete relief, in 60 percent it gave partial relief, and in 20 percent there was no relief.

In 1937 these observers[23] presented statistics on 829 patients examined for aniseikonia at the Eye Clinic at Dartmouth. Of this number, 625 received prescriptions for the correction of aniseikonia, and 500 of these were wearing the correction at the time the study was being made. Of the 500 patients to whom questionnaires were sent, 425 replied relative to the efficacy of the glasses. Definite relief from ocular and general symptoms was reported by 283 (57 percent).

Jackson[32] believes that aniseikonia causes no trouble in congenital or in developmental cases, but in adults, when the refraction is corrected and there is disturbance of the sensorimotor coördination that affects binocular vision, symptoms may develop.

Allen[33] offered the opinion that the principal role in the correction of aniseikonia will be found in helping those who occupy the middle place in anisometropia; that is, those between (1) comfortable patients with small refractive differences, and (2) patients with large refractive differences who cannot possibly wear the full correction for eyes with unequal retinal images. Allen believes that the eyes are capable of perceiving a difference in size of 0.25 percent. He also described a method of determining differences in size by the use of central fixation and fusion with the stereoscope. This test will be discussed under examinations for aniseikonia.

One of the arguments against the possible clinical importance of aniseikonia was voiced because of the differences in the ocular images that developed in asymmetrical convergence. The work of Herzau and Ogle[34] and some of the observations of the Dartmouth group have shown that the eye apparently compensates for the aniseikonia present in asymmetrical convergence. The exact manner in which the eye adjusts itself to equalize the size of the images is unknown, but it is possible that accommodation is a factor. This paper apparently refutes the statements made by Ludvigh[35] concerning the correction of aniseikonia.

Opinions vary in regard to the importance of aniseikonia and as to what the correction of this condition may accomplish. For example, Ludvigh[35] believes that differences of image size between the two eyes occur normally in reading. He also states that these differences are much greater in magnitude than those which it has been deemed advisable to correct by the use of aniseikonic lenses. He concludes that the contention for the existence of aniseikonia, other than that due to obvious physical-optical causes, is based upon inconclusive evidence and derives little support from theory, since it has not been demonstrated that the patients' complaints are attributable to the condition with which the theory deals. However, Brandenburg[36] believes that there is every indication that the discovery of aniseikonia marks a new era in the history of the alleviation of human suffering by scientific means.

Symptoms of aniseikonia

The symptoms complained of by patients who were examined for aniseikonia by means of the ophthalmo-eikonometer are similar to those reported in 1937,[37] which included visual disturbances (blurred vision, diplopia, fixation difficulty, and squint), ocular discomfort, photophobia, headache, and general symptoms referable to the gastro-intestinal tract (for example, gastric disturbances, nausea, and indigestion) and nervous system (for example, tenseness, irritability, vertigo, headache, and general nervous exhaustion). Indefinite symptoms of ocular discomfort, aggravated by reading, viewing motion pictures, and driving automobiles, were common complaints. The majority of patients stated that they suffered ocular discomfort and headaches, especially while reading. Ocular pain or pain about the eyes, uncomfortable or blurred binocular vision, burning, lacrimation, and blepharospasm were occasional symptoms.

It is evident that none of the disturbances mentioned is a differentiating characteristic of a specific eye condition, and that many of them apparently are often relieved by wearing ordinary lenses, prismatic lenses, or tinted glasses. Orthoptic training, the treatment of general diseases, and even suggestion and psychoanalysis have also been effective in ameliorating symptoms of this character.

Causes of aniseikonia

There are three groups of physical factors which influence the size of the physical image which falls on the retina: (1) The physical character of the object which includes its size, shape, distance, and lateral position (asymmetrical convergence);[34] (2) the optical character of the correcting lens, such as the power, position, flexure, and thickness, and (3) the dioptric character of the eye, which includes refractive error, focal length, and the position of the nodal point.

In addition, there are two groups of neurologic factors that influence the projection of this physical image into space as a mental perception: First, the neuro-anatomy of the receptor mechanism must be considered. This factor depends upon the mosaic pattern of the nerve endings in the retina and upon the distribution of the nerve fibers in the occipital centers. Second, some psychologic factors of the perceptive mechanism are of importance, especially the association with simultaneous perceptions and with previous visual perceptive knowledge and habits.

Hence the ocular images, as we consider them in relation to aniseikonia, are the end-result of these groups of factors. When there is a difference in this end-result between the two eyes, there is a condition of unequal ocular images—aniseikonia.

Examining for aniseikonia

In testing for aniseikonia the following statements by Ames and his associates should be considered: (1) It is possible to perceive a size difference of less than 0.25 percent; according to Neumuller,[38] however, aniseikonia of less than 0.25 percent should be measurable. (2) Eyestrain may be caused by a size difference as small as 0.5 percent, although many persons can fuse greater differences with no apparent effort.

Examination with the ophthalmo-eikonometer.—In order to make an accurate test for aniseikonia with the ophthalmo-eikonometer, the patient must have sufficient vision to be able to discern spots and lights on the screen. Best results are obtained with vision better than 6/12, or possibly 6/15, in each eye. The patient must have simultaneous binocular perception, with no defect in his central field, and at the same time be able to fuse the images of the large central fixation spot. In cases of diplopia in which images cannot be superimposed spontaneously by the extraocular muscles, no accurate test can be made.

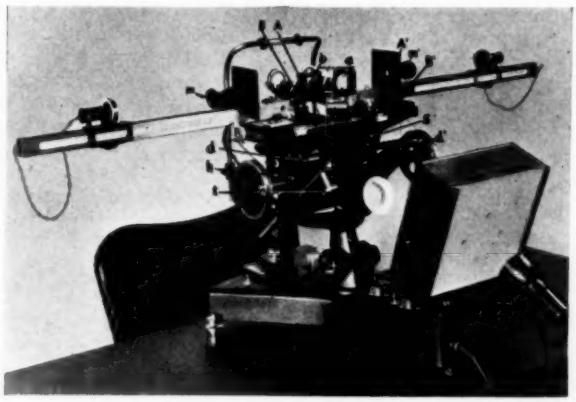

Fig. 1 (Berens and Loutfallah). Ophthalmo-eikonometer.

Aniseikonia cannot be considered as independent of other ocular functions. Since distortion of images frequently affects the dioptric condition of the eyes, and *vice versa*, a balanced condition, particularly of accommodation, as well as equalization of image size, is necessary. For this reason the ophthalmo-eikonometer (fig. 1) is designed so that patients may be tested successively for—(1) binocular single vision; (2) visual acuity;

(3) heterophoria and fusional amplitudes; (4) dioptric condition—spherical ametropia and meridional ametropia (astigmatism), and (5) aniseikonia.

Statistical study

In order to clarify our understanding of aniseikonia as a clinical problem an analysis has been made of the results obtained in 711 hospital-private patients (group 1) examined at the New York Eye and Ear Infirmary and 125 private patients (group 2), some of whom were also examined in the Dartmouth Eye Institute of the Dartmouth Medical School (table 1).

TABLE 1

Results of the examination of 711 hospital patients and 125 private patients with the ophthalmo-eikonometer

	Group 1: Number of Hospital Patients		Group 2: Number of Private Patients	
No measurement possible	52		12	
No aniseikonia	132		31	
No iseikonic prescription worn:				
a. No prescription given	61	343 (48.2%)	19	75 (60%)
b. Prescription given but lenses not obtained	62		13	
No report	36			
Iseikonic prescription worn		368 (51.8%)		50 (40%)
a. Marked relief	164 (45%)		17 (34%)	
b. Moderate relief	86 (23%)	269 (73%)	6 (12%)	37 (74%)
c. Slight relief	19 (5%)		14 (28%)	
d. No relief of symptoms	99 (27%)		13 (26%)	
Totals		711 (100%)		125 (100%)

Results of the examination of 711 hospital patients and 125 private patients with the ophthalmo-eikonometer. Of the 711 hospital patients (table 1, group 1) examined with the ophthalmo-eikonometer, 368 were given iseikonic correction, 52 could not be measured for aniseikonia, 132 patients had no significant aniseikonia (less than 0.5 percent), 61 patients with aniseikonia were not given prescriptions, 62 patients did not obtain their iseikonic lenses, and 36 patients who wore iseikonic lenses did not report upon the effect of the lenses.

Some relief of symptoms was reported by 73 percent of the 368 patients who wore the iseikonic correction, and who reported the effect of wearing the lenses. In 164 patients (45 percent) the symptoms were markedly relieved, in 86 patients (23 percent) they were somewhat relieved, in 19 patients (5 percent) they were slightly relieved, and 99 patients (27 percent) experienced no relief (table 1).

Of the 125 private patients (group 2), 50 were given iseikonic correction, tests were incomplete in 12 patients, and 31 patients, had no aniseikonia, or less than 0.5 percent. The private patients were examined carefully by all the methods at our disposal, and usually several modes of treatment were tried before the iseikonic lenses were prescribed. Of the patients who had aniseikonia, 19 were not given iseikonic lenses and 13 did not obtain their iseikonic lenses. Some relief of

symptoms was reported by 74 percent of the patients who wore iseikonic lenses. Of the 50 patients who wore their iseikonic lenses, 17 (34 percent) were markedly relieved, 6 (12 percent) were moderately relieved, 14 (28 percent) were slightly relieved, and 13 (26 percent) experienced no relief.

Discussion of table 1.—A comparison of group 1 and group 2 reveals that of the patients who were given iseikonic lenses in group 1, 45 percent obtained marked relief, 23 percent moderate relief, whereas 5 percent experienced slight relief. However, 27 percent obtained no relief of symptoms. In group 2, 34 percent experienced marked relief, 12 percent obtained moderate relief, 28 percent had slight relief, and 26 percent had no relief of symptoms. Thus it may be seen that approximately the same percentage of improvement was secured in both groups.

TABLE 2

RESULTS OF TESTS FOR ANISEIKONIA IN HETEROTROPIA (43 HOSPITAL PATIENTS AND 26 PRIVATE PATIENTS)

	Group 1: Number of Hospital Patients	Group 2: Number of Private Patients
No measurement possible	18 (42%)	11 (43%)
Alternating squint		5
Monocular squint		6
No or slight degree of aniseikonia	3 (7%)	5 (19%)
Alternating squint		4
Monocular squint		1
No prescription given	10 (23%)	
No report	2 (5%)	
Glasses not worn (2 for cosmetic reasons)	6 (14%)	4 (14%)
Alternating squint		3
Monocular squint		1
Iseikonic prescription worn	4 (9%)	6 (24%)
Alternating squint		4
Monocular squint		2
a. Marked relief	3 (75%)	1 (20%)
b. Moderate relief		3 (50%)
c. No relief	1 (25%)	2 (30%)
Totals	43 (100%)	26 (100%)

Discussion of tables 2, 3, 4, 5, and 6.—An attempt has been made to divide both groups of patients into the following divisions: (1) Patients with heterotropia (table 2), in whom we endeavored to determine whether iseikonic lenses would aid in developing fusion; (2) patients with heterophoria and ametropia, in whom we were interested in determining whether the iseikonic lenses would relieve annoying symptoms (table 3); (3) patients with heterophoria with refractive errors whose symptoms were unrelieved by ordinary lenses (table 4); (4) patients with minor errors of refraction (tables 5 and 6); (5) patients with marked anisometropia (a difference in refraction of 2.50 D. or more) (table 6); and (6) patients with reading difficulties (table 7).

Results of tests for aniseikonia in patients with heterotropia.—Of the group of 43 hospital patients (table 2) with heterotropia no measurement was possible in 18 patients, no aniseikonia was present in 3, iseikonic lenses were not prescribed in 10, the iseikonic lenses were not worn by 6 patients, and 2 patients who wore the iseikonic lenses did not report their effect. Of the 4 patients with heterotropia who reported concerning the effect of the lenses, one obtained

unfavorable results and 3 gave favorable reports.

Of the 26 patients in the private-patient heterotropia group (group 2, table 2), many who were examined with the ophthalmo-eikonometer had been operated upon, and all had received orthoptic training. In some of these cases it was impossible to develop stable fusion as tested with the screen test. In others, however, some fusion was finally developed, but amplitude of fusion was not obtained. Eleven of the tests were incomplete (table 2). Five patients had no appreciable aniseikonia. Four patients did not wear the iseikonic lenses; 2 of these discarded the lenses, after wearing them for a trial period, for cosmetic reasons. Of the 6 patients who wore iseikonic lenses, one obtained marked improvement, 3 moderate relief, and 2 no relief. Of these 6 patients, 4 had alternating strabismus and 2 had monocular squint (table 2).

Discussion of table 2.—In table 2 a comparison of groups 1 and 2 reveals that 9 percent of the hospital patients and 23 percent of the private patients wore iseikonic lenses. According to this analysis, 4 private patients and 3 hospital patients with heterotropia apparently were benefited by iseikonic lenses. Table 2 suggests that patients with heterotropia who do not obtain a satisfactory result from operation and orthoptic training, or from orthoptic training alone, should be examined for aniseikonia. However, accurate measurements often cannot be made with the ophthalmo-eikonometer because of the patient's age, the limitation of the present apparatus available to us for studying aniseikonia in heterotropia, the lack of fusion, and in cases of amblyopia because of insufficient vision. Work on improved methods for the examination of these patients is now in progress at Dartmouth.

TABLE 3

RESULTS OF THE EXAMINATION FOR ANISEIKONIA IN HETEROPHORIA AND AMETROPIA (459 HOSPITAL PATIENTS AND 77 PRIVATE PATIENTS)

	Group 1: Number of Hospital Patients		Group 2: Number of Private Patients	
No measurement possible.		25 (5%)		
No aniseikonia		86 (19%)	15 (19%)	
No prescription given		41 (9%)	19 (25%)	
Prescription not obtained		36 (8%)	4 (5%)	62 (81%)
No report		21 (4.6%)		
Effect of wearing iseikonic lenses		250 (54.4%)	39 (51%)	
a. Unfavorable report	75 (30%)		11 (28%)	
b. Favorable report	175 (70%)		28 (72%)	
(1) Marked improvement	106		14	
(2) Moderate improvement	56			
(3) Slight improvement	13		14	
Totals		459 (100%)		77 (100%)

Results of the examination for aniseikonia in patients with heterophoria and ametropia.—Of the 711 hospital patients examined at the New York Eye and Ear Infirmary heterophoria and ametropia were present in 459 (table 3, group 1). In 25 of these patients, no measurement was possible, in 86 patients, no aniseikonia (or less than 0.5 percent) was present, in 41 no iseikonic prescription was given, in 36 the iseikonic prescription was

not worn, and 21 patients did not report concerning the effect of the lenses. Of the patients who reported concerning the effect of wearing the lenses, 75 (30 percent) reported unfavorable results and 175 (70 percent) reported favorably. Of those reporting favorably, 106 had obtained marked relief, 56 moderate relief, and 13 but slight relief.

There were 77 private patients (group 2, table 3) with heterophoria and ametropia who were examined for aniseikonia. Of this group, 15 had no appreciable aniseikonia. Of the 62 patients who had aniseikonia, iseikonic lenses were not prescribed in 19, and 4 patients did not obtain the lenses. Of the 39 patients who wore iseikonic lenses, 11 discarded them after a short trial, 14 were markedly relieved, and 14 were slightly relieved.

Effect of iseikonic correction in relieving symptoms in patients with heterophoria.—Of the 28 private patients with heterophoria wearing iseikonic lenses, 17 complained of headache (table 4, group 2). Fifteen were relieved by the wearing of iseikonic lenses, although 2 were only partially relieved, and 2 were unrelieved. The wearing of iseikonic lenses gave relief in 17 patients suffering from asthenopia and in one case of vertigo. Of the 10 patients with reading difficulty, 9 were relieved and one was unrelieved, and iseikonic lenses did not relieve the one patient who complained of nausea.

TABLE 4

EFFECT OF ISEIKONIC CORRECTION IN RELIEVING SYMPTOMS IN 28 PRIVATE PATIENTS WITH HETEROPHORIA

Symptoms	Group 2: Number of Patients	
	Relieved	Not Relieved
Headache	15*	2
Asthenopia	17	—
Reading difficulty	9	1
Vertigo	1	—
Nausea	—	1

* Two of these patients were partially relieved.

TABLE 5

RESULTS OF THE EXAMINATION FOR ANISEIKONIA IN 59 HOSPITAL PATIENTS WITH NO APPRECIABLE ERROR OF REFRACTION

		Group 1: Number of Patients	
No measurement possible		1 (2%)	
No aniseikonia		17 (29%)	
No prescription given		3 (5%)	
Lenses not obtained		10 (17%)	
No report		3 (5%)	
Effect of iseikonic lenses:			
a. Unfavorable report		3 (12%)	25 (42%)
b. Favorable report		22 (88%)	
(1) Slight improvement	1		
(2) Moderate improvement	7		
(3) Marked improvement	14		
Total		59 (100%)	

Ordinary lenses did not entirely relieve the symptoms in any of the 28 private patients with heterophoria who wore iseikonic lenses.

Discussion of table 3.—These figures suggest that 175 hospital patients (70 percent) and 28 private patients (72 percent) who had heterophoria and were ametropic were benefited by wearing iseikonic lenses after ordinary treatment had failed.

Results of the examination for anisei-

konia in patients with no appreciable error of refraction.—Of the 59 hospital patients who had no appreciable error of refraction (table 5, group 1), no measurement was possible in one case, no aniseikonia (less than 0.5 percent) was present in 17 patients, 3 were not given iseikonic prescriptions, and 10 patients did not obtain their iseikonic lenses. Three patients did not report concerning the effect of the lenses, 3 obtained no relief of symptoms, and 22 (88 percent) reported favorably. Of the favorable reports, 14 patients were markedly relieved, 7 moderately relieved, and one slightly relieved.

Results of the correction of aniseikonia in heterophoria and anisometropia.—Of the group of hospital patients, 55 had anisometropia under 1.00 D. (table 6). Two of these patients could not be measured for aniseikonia, 6 had no aniseikonia, 2 were not given iseikonic prescriptions, and 5 did not wear their iseikonic lenses. Of the patients who did wear iseikonic lenses, 2 did not report the effect of the lenses, 7 reported unfavorably, and 31 (81.5 percent) reported favorable results. Of those reporting favorably, 19 were markedly improved, 10 moderately so, and 2 slightly improved.

Twelve of the 28 private patients with heterophoria had anisometropia of less than 1.00 D.; 8 derived marked benefit from the lenses, and 4 obtained partial benefit (table 6).

Of the 48 hospital patients who had anisometropia of from 1.00 D. to 2.50 D., one patient could not be measured, 5 had no aniseikonia, 4 were not given iseikonic prescriptions, and 3 did not obtain iseikonic lenses. Of the patients who wore iseikonic lenses, 5 did not report the effect of the lenses, 9 reported unfavorably, and 21 reported favorably. Of those reporting favorably, 11 were markedly improved, 7 were moderately improved, and 3 were slightly improved.

Of the 26 hospital patients (Group 1) who had anisometropia of over 2.50 D., 4 could not be measured for aniseikonia, one was not given an iseikonic prescription, and 2 did not obtain their iseikonic lenses. Of the patients who wore their iseikonic lenses, 4 reported unfavorably and 15 obtained favorable re-

TABLE 6

RESULTS OF CORRECTION OF ANISEIKONIA IN HETEROPHORIA AND LARGE AND SMALL DEGREES OF ANISOMETROPIA (129 HOSPITAL PATIENTS AND 13 PRIVATE PATIENTS)

	Group 1: Number of Hospital Patients			Group 2: Number of Private Patients	
	Under 1.00 D.	1.00 D.–2.50 D.	Over 2.50 D.	Under 1.00 D.	2.50 D. or Over
No measurement possible	2	1	4	—	—
No aniseikonia	6	5	—	—	—
No prescription given	2	4	1	—	—
Lenses not obtained	5	3	2	—	—
No report	2	5	—	—	—
Effect of iseikonic lenses:					
a. Unfavorable report	7	9	4	—	—
b Favorable report	31 (81.5%)	21 (70%)	15 (80%)	12(100%)	1 (100%)
1. Marked relief	19	11	10	8	—
2. Moderate relief	10	7	5	4	1
3. Slight relief	2	3	—	—	—
	55	48	26	12	1
Totals	129			13	

sults. Of the favorable cases, 10 were markedly relieved and 5 were moderately relieved.

There was one private patient with more than 2.50 D. of anisometropia. Iseikonic lenses apparently relieved the headache of which she complained and partially relieved asthenopia.

Results of tests for aniseikonia in patients with reading difficulties.—Of the 21 hospital patients who had reading difficulties in addition to aniseikonia, one could not be measured, and 15 had no aniseikonia (less than 0.5 percent) (table 7). Three patients who wore iseikonic lenses did not report. Both patients who reported concerning the effect of the lenses replied favorably. One patient was markedly improved and one was moderately improved.

A group of 22 private patients (group 2, table 7) who complained of reading difficulties were examined with the ophthalmo-eikonometer. In addition, the following complete studies were made of these patients as part of the reading diagnostic service of the New York Eye and Ear Infirmary. The diagnostic technique consisted of: (1) Psychologic studies and reading achievement tests; (2) tests with the ophthalmograph; (3) Betts's ready-to-read cards; (4) routine muscle study; (5) determination of refraction—static and dynamic; (6) visual-field studies; (7) tests for stereopsis, and (8) studies of ocular fatigue, both accommodation and convergence. Treatment consisted of general medical treatment and of ocular therapy; for example, correcting lenses, special lenses to overcome aniseikonia, and orthoptic training. Exercises were prescribed for convergence, divergence, supravergence, and accommodation. Psychotherapy, consisting of special exercises and training, utilization of the metronoscope (rhythmic reading training), and the use of the typewriter were advised.

Eleven of the 22 patients had no appreciable (under 0.5 percent) aniseikonia and in one no determination was possible. Of the 10 patients who had aniseikonia, iseikonic lenses were worn constantly by 5, 2 of whom obtained marked relief from symptoms, and 3 moderate relief. Five patients were not given iseikonic prescriptions.

TABLE 7

RESULTS OF TREATMENT OF ANISEIKONIA IN READING DIFFICULTIES (21 HOSPITAL PATIENTS AND 22 PRIVATE PATIENTS)

	Group 1: Number of Hospital Patients	Group 2: Number of Private Patients
No aniseikonia	15 (71%)	11 (50%)
No determination	1 (5%)	1 (5%)
No report	3 (14%)	
No iseikonic prescription given		5 (22.5%)
Iseikonic prescription worn	2 (10%)	5 (22.5%)
a. Marked relief	1	2
b. Moderate relief	1	3
Totals	21 (100%)	22 (100%)

SELECTED REPORTS OF THE TREATMENT OF ANISEIKONIA IN SEVERAL PRIVATE PATIENTS

A more detailed report of 4 patients included in the group of 125 private patients shows some of the difficulties encountered in evaluating the results of wearing iseikonic lenses.

Case 1. S. W., aged 14 years, complained of headache after reading for half an hour. He was wearing the follow-

ing ordinary lenses for correction of ametropia: right eye, +0.25 D. sph.; left eye, +0.25 D. cyl. ax. 105°. With correction, his vision was 6/6 in each eye. The near point of accommodation was 80 mm./300 mm. in the right eye and 240 mm./300 mm. in the left eye. The muscle findings were: at 6 m., orthophoria; at 25 cm., exophoria of 2.5$^{\Delta}$. The near-point of convergence was 55 mm. His prism divergence at 6 m. was 3$^{\Delta}$ and at 25 cm. 5$^{\Delta}$; his prism convergence was 10$^{\Delta}$ at 6 m. and 25 cm.

On November 30, 1935, the patient was given the following iseikonic prescription for near: right eye, +0.50 D. sph. combined with 1 percent meridional × 90 degrees; left eye, +0.50 D. sph. combined with 1.5 percent meridional × 180 degrees. With this iseikonic correction the near point of accommodation was 105 mm./300 mm. in the right eye and 98 mm./300. in the left eye.

Apparently marked benefit was derived from wearing the iseikonic lenses, for the patient stated that he could not read without this correction and that since wearing his iseikonic prescription he had had no headache. We are still at a loss to explain the rapid changes in accommodation, as there was no demonstrable fatigue of accommodation when he was tested with the ophthalmic ergograph. He apparently had some upper respiratory infection which might have been a factor not only in causing the changes in accommodation, but also in the apparent benefit obtained from the iseikonic correction.

Case 2. J. T., aged 33 years, complained of eyestrain when reading. With his ordinary correction of +0.25 D. cyl. ax. 3° in the right eye and +0.25 D. cyl. ax. 175° in the left eye, his vision was 6/4.5 in each eye. The near point of accommodation was 200 mm./300 mm. in the right eye and 180 mm./300 mm. in the left eye. The muscle findings were: at 6 m., esophoria 1$^{\Delta}$ and at 25 cm., exophoria of 30$^{\Delta}$; at 6 m., prism divergence was 3$^{\Delta}$ and prism convergence 10$^{\Delta}$; at 25 cm., prism divergence was 10$^{\Delta}$ and prism convergence was 15$^{\Delta}$. The near point of convergence was 140 mm.

Iseikonic lenses were prescribed for near on March 19, 1936. The prescription was: right eye, plano combined with 0.5 percent overall, combined with 2 percent meridional × 90 degrees; left eye, plano. With correction, the near point of accommodation was 130 mm./300 mm. in the right eye and 130 mm./300 mm. in the left eye. On June 26, 1936, when the patient was last seen, he stated that although his eyestrain was not completely relieved, it was much less marked.

This patient obtained only partial benefit from wearing the iseikonic correction. The convergence insufficiency was considered another factor partly responsible for his discomfort.

Case 3. T. M. H., aged 25 years, complained of ocular fatigue, inability to read, and headache. With ordinary correcting lenses of +0.25 D. cyl. ax. 180° for the right and left eyes his vision was 6/4.5 in each eye. The near point of accommodation was 120 mm./400 mm. in each eye. The muscle findings were: at 6 m., orthophoria; at 25 cm., esophoria 1$^{\Delta}$. The near-point of convergence was 35 mm. At 6 m., prism divergence was 8$^{\Delta}$ and prism convergence was 12$^{\Delta}$; at 25 cm., prism divergence was 12$^{\Delta}$ and prism convergence 40$^{\Delta}$.

The following iseikonic lenses for near were prescribed on January 31, 1935: right eye, plano combined with 1.25 percent overall; left eye, plano. The patient was last seen on September 9, 1935; with his iseikonic correction he was able to read without difficulty for from two to three hours, and marked improvement of ocular symptoms was noted. In April,

1938, the patient reported that he could not read comfortably or for any length of time without his iseikonic lenses, and that his rate of reading had increased.

Case 4. Miss M. E. S., aged 18 years, complained of eyestrain and headache. With ordinary lenses of −2.00 D. sph. ⌯ −0.50 D. cyl. ax. 40° in the right eye and −2.00 D. sph. ⌯ −0.62 D. cyl. ax. 150° in the left eye, her vision was 6/6 in each eye. The near point of accommodation was 100 mm./300 mm. in the right eye and 110 mm./300 mm. in the left eye. The muscle findings were: orthophoria at 6 m. and 25 cm. The near point of convergence was 45 mm. At 6 m., prism divergence was 5Δ and prism convergence was 10Δ. At 25 cm., prism divergence was 8Δ and prism convergence was 25Δ.

On April 5, 1937, the following iseikonic lenses were prescribed for constant wear: right eye, −2.00 D. sph. ⌯ −0.50 D. cyl. ax. 25° combined with 1.5 percent overall combined with 1.5 percent meridional × 90 degrees; left eye −2.00 D. sph. ⌯ −0.50 D. cyl. ax. 165°.

The patient was last seen on November 27, 1937, and showed definite improvement. She was able to read twice as rapidly, and was able to use her eyes from 8 a.m. to 11 p.m. Although her headaches still persisted, they were less severe than formerly.

Summary

A clinical study of 711 hospital patients and 125 private patients examined with the ophthalmo-eikonometer was made in an attempt to evaluate the results obtained following the correction of aniseikonia by means of iseikonic lenses.

A review of the history of aniseikonia reveals the fact that inequality of retinal images was looked upon as a problem in prescribing lenses as early as 1864. The importance of aniseikonia has been stressed by Ames and his associates in their studies of size differences, and we are indebted to them for much of our present interest in and knowledge of aniseikonia and for methods of diagnosing and correcting this condition.

The symptoms complained of by patients with aniseikonia are not indicative of this condition or of any specific eye disease. The most common of these are: Visual disturbances, ocular discomfort, photophobia, headache, and the general manifestations associated with the gastrointestinal tract and nervous system.

The causes of aniseikonia may be optical, anatomic, or neuropsychologic. The compensatory mechanism for equalizing the size of ocular images which has been shown to exist in asymmetrical convergence by Herzau and Ogle may also be effective in overcoming size differences that occur when the eyes are in the primary position. In our experience we have found that the majority of patients who have worn iseikonic corrections with apparent comfort have been of the "hypersensitive" type. Every effort should be made to discover and correct underlying physical and psychologic factors. It is quite possible that small differences in the size of ocular images may disturb one person and be well tolerated by another who is less sensitive. We believe this statement is also true for the ordinary errors of refraction and for low degrees of heterophoria. In addition to eliminating any existing underlying physical causes, it is quite possible that orthoptic training may prove to be a factor in increasing the amplitude of size fusion.

In testing for aniseikonia the ophthalmo-eikonometer is used. It has been stated elsewhere that differences of 0.25 percent are measurable. In order to employ the ophthalmo-eikonometer in testing size differences patients must have vision better than 6/12, or possibly 6/15, in each eye. Moreover, they must be able

to fuse the images of the large central fixation spot on corresponding areas of the retinas.

Aniseikonia must be considered in relation to other ocular conditions. For this reason the ophthalmo-eikonometer may be used to test binocular vision and visual acuity; for heterophoria, fusional amplitude, and refraction, as well as for aniseikonia. The ophthalmo-eikonometer includes a head-rest, cells for trial-lenses, and a dioptric system for studying refraction; a screen is used to project lights and dots. Any disparity in the relative position of the lights and dots indicates the apparent difference in the size of the ocular images. Adjustable size-lenses are used to measure the degree of aniseikonia. These lenses consist of overall and meridional size-lenses.

Although aniseikonia is not always the underlying cause of symptoms in patients who complain of ocular fatigue, asthenopia, and vertigo, when these symptoms are not relieved by correcting lenses and other therapeutic measures the possible existence of aniseikonia should be investigated.

Of the 711 hospital patients and 125 private patients who were examined for aniseikonia, the iseikonic prescription was worn by 368 patients (51.8 percent) in group 1 (hospital-private patients), and in 50 patients (40 percent) in group 2 (our private patients). In group 1, 73 percent of the patients obtained some relief of symptoms, whereas in group 2, 74 percent secured some relief.

Conclusions

The data presented in this paper would seem to indicate that the correction of aniseikonia may be a factor in some cases in relieving ocular complaints and general symptoms that apparently are not alleviated by the wearing of ordinary correcting lenses, orthoptic training, and other forms of treatment. In some cases the correction for ametropia was changed, and in others accommodation seemed to be improved for some unknown reason; muscle balance was undoubtedly changed in some instances, and fluctuations in the physical condition may have been coincident with the wearing of the iseikonic lenses; these and other factors should be taken into consideration in evaluating the results. Possibly one of the most important factors, and one that is most difficult to evaluate in highly sensitive or neurotic patients, is the effect of a new, carefully conducted examination and the wearing of a new type of lens.

The more one learns of the correction of aniseikonia, the more one is convinced that there are few if any uncomplicated cases of aniseikonia, and we have pointed out some of the important related factors that should be considered. The experience and conclusions drawn from the study of aniseikonia seem to parallel those observed in the correction of anisometropia and heterophoria.

Until many additional examinations of patients for aniseikonia have been critically analyzed, and improved methods of diagnosing and correcting aniseikonia have been given a thorough trial, it is advisable to preserve a scientific interest in the study of aniseikonia. Some of our patients who complain of asthenopia and other forms of ocular discomfort, and who are not relieved by the usual methods of treatment might well be examined for aniseikonia.

We are indebted to Mr. Harold M. Fisher for the summary of the 711 hospital-private patients (group 1) examined by him on the ophthalmo-eikonometer, and to Miss Dorothy Kern for the summary of the 125 private patients (group 2).

Discussion

Dr. Edward Jackson, Denver: The two papers [one by Dr. Lancaster, Ed. note] on aniseikonia bring to our minds the fact that we are dealing with the borderland of natural science and investigation. They both illustrate how closely our observations and vision are related to the question of cerebral action and association. They teach this lesson, that these particular functions are not mathematical optics, or physical optics. They are not the ordinary uses of our voluntary muscles, or the known acts of vision. We are getting beyond the boundaries of what the mass of people have learned to do with their eyes, and individual differences must be considered before we will understand the significance, for instance, of the tables that were presented to us. Take one statement in the paper of Dr. Berens and Dr. Loutfallah: that ordinary lenses had not given satisfaction, but the iseikonic correction was more satisfactory. We ought to consider that in these cases the particular individuals possibly had not had a perfect correction of their ametropia. They may possibly have made in early childhood a certain use of the eyes that did predispose them away from perfect association of the two eyes, in the ordinary processes of vision. Until we eliminate such factors we cannot judge any one possible factor in the bringing about of relief. I believe that we must approach this subject with the realization that we are entering a new field; that some lessons which we believe we have learned will have to be reconsidered, before we can judge of the apparently new facts that are brought to our attention.

Dr. Hermann M. Burian, Hanover, N.H. (by invitation): Although it might appear presumptuous for me to discuss the papers by Drs. Lancaster and Berens and Loutfallah, I should like to stress a few points in connection with the aniseikonia problem, since Dr. Lancaster wishes me to do so. First of all, however, I want to congratulate Dr. Lancaster on his masterly presentation of this complicated subject, in which we are especially interested at the Dartmouth Eye Institute, and Dr. Berens and Dr. Loutfallah for the detailed analysis of so great a number of cases.

Dr. Lancaster has hinted at the problem which I have studied and about which I am going to report at the meeting of the American Medical Association, in June, 1938. The importance of peripheral fusional stimuli for the relative position of the two eyes is in itself a well-rounded problem of physiologic optics, and its investigation was not undertaken with a specific regard to aniseikonia. As a side-result, however, as Dr. Lancaster pointed out, we obtained conclusive proof that the measurements of artificially induced size differences are identical, whether they are taken with or without eye-movements. In other words, we are obviously measuring an actual size-difference, not a possible anisophoria. The instrument I used in my experiments is at the Scientific Exhibit of the American Medical Association, and I shall be glad to demonstrate the effects to any one interested in them. This instrument allows one to measure aniseikonia also in cases in which there is no binocular vision, provided that the innate retinal correspondence is intact.

I should like to mention one point which I believe has thus far not sufficiently been brought out in the discussion of aniseikonia. We must assume that the relative difference in the size of the ocular images gives rise to difficulties in fusing the images of the two eyes. The

result is that in persons affected with aniseikonia the constant struggle to bring about and maintain fusion produces the well-known symptoms. We must rely on the reports of the patients as to the relief they obtained by wearing an iseikonic correction, and from these reports we must draw our conclusions concerning the validity of our assumption of the effectiveness of size-corrections. There is, however, an objective sign which seems to me especially convincing as to the value of aniseikonic corrections for the achievement of perfect binocular vision. This is the fact that, through the wearing of an iseikonic correction, a marked improvement of depth perception can be obtained. In a number of cases intelligent patients who are careful observers report spontaneously that they have noticed such an improvement, or that, for the first time, they have experienced real stereoscopic, three-dimensional vision. In connection with this they often report a considerable improvement in fine, close work and certain outdoor activities. We have checked this subjective impression of the patients—for instance, with the Keystone chart—and found that there actually is a very marked improvement in their depth perception. If such patients do not wear their glasses for a few hours, their depth perception will be more or less reduced. Immediately after putting on the glasses they show 100-percent depth perception, and they do not lose it for a longer or shorter time after taking the glasses off again.

Finally, I should like to mention another point. Dr. Berens has stated that in his cases there was no noticeable influence of the iseikonic corrections on the phorias of the patients. This is not astonishing, and it is evident that we cannot expect such an influence, if we define the phorias as the position of rest of the eyes. This position, in so far as it is due to mechanical factors, can, of course, not be expected to change. Under normal conditions of seeing, it is not true that all innervational influences are excluded, and we can readily conceive that it will be much easier for a patient with a considerable amount of phoria to overcome the anomaly in the position of rest, if the process of fusion is facilitated by matching the images of the two eyes. This is probably another important factor which contributes to the great benefit some patients derive from the wearing of iseikonic corrections.

DR. CONRAL BERENS, closing: I would like to thank Dr. Jackson for his remarks. I do not know whether I quite understood them, but I would like to refer him to the first paragraph of the conclusions in our paper.

I did state that this particular patient, as well as others, had actually tried ordinary lenses, and then changed to the iseikonic lenses. My desire was to make clear how difficult it is to evaluate the results obtained in these patients.

Dr. Burian has added important data to the material we have presented, and I hope that the Society will continue to give this problem further scientific consideration.

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ADRENAL NEUROBLASTOMA AND ITS OCULAR SYMPTOMS

A CASE REPORT WITH AUTOPSY

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Neuroblastoma is one of the three types of sympathetic-nerve tumors which arise from the adrenal medulla. Being composed of undifferentiated cells, it is the most malignant and also the most frequent tumor found in this organ. The two other pathologic types of sympathetic-nerve tumors, ganglioneuroma and chromaffine-cell tumor, arise from adult cells; they cannot always be sharply separated from neuroblastomas, as newly formed elements of all three types may be found in the same tumor and cases of purely one type are rare (Wahl[1]). Virchow,[2] in 1864, was the first to recognize its nature, but referred to it as glioma; Marchand[3] (1891) discovered its neural nature, and Pepper[4] (1901) and Hutchinson[5] (1907) described very clearly its characteristic clinical pictures; but not earlier than in 1910 was the term "neuroblastoma" used, and the neuroblastic theory established by Wright.[6]

With regard to the clinical appearance of the disease, there have been described two different types. The one that is of most interest for ophthalmologists is the Hutchinson type, in which metastases occur chiefly in the orbit, skull, meninges, and long bones. Leinfelder[7] stated that the other type, described by Pepper, has no ocular manifestations, since metastases occur primarily in the liver; but Klein[8] (1932) described a case which he attributed to the Pepper type, with ecchymoses over the lids of both eyes, and Boyd[9] admits that the bones of the skull are occasionally involved also in cases of the Pepper type. Frew[10] (1911) is of the opinion that spread of the neoplasm occurs via the lymphatics and that anatomical consideration will explain the two different clinical types. Wahl, however, believes that the metastases occur chiefly by way of the blood stream. According to Geschickter[11] (1933) clinical division between the two types is pathologically misleading, as the various manifestations caused by the metastatic predilections for certain regions are dependent neither on the cell type nor on the relation of the primary tumor of the neighboring lymph or blood vessels but rather to the age of the patient.

The disease occurs nearly exclusively in young children, mostly—in about one half of 40 cases of Lewis and Geschickter—under three years of age, sometimes even in fetal life, very seldom in children over the age of 10 years. Cases in adults have been described, but, according to Boyd, such a diagnosis is extremely risky. No cases in adults have been reported with any ocular complication. There seems to be no preference for the male or female sex, and heredity probably plays no part.

The disease is very rare. In 1933, Scott, Oliver, and Oliver[12] collected from the whole literature 158 cases of adrenal-medulla tumors, only 83 of which were sympatico-blastomas. In 1934, Lewis and Geschickter[13] published 40 cases more, 33 of which occurred in the medulla of the suprarenal gland. In 1935, Leinfelder added three new cases. Saphir[14] saw adrenal neuroblastoma once in 3,950 autopsies. Frew stated that in 7,000 autopsies on children under 12 years of age only 24 cases were reported. Ocular complications were mentioned in one of 9 cases of Wollstein,[15] in 2 of 17

cases of Askin and Geschickter,[16] and in all 3 cases of Leinfelder, also in 26 of the 40 cases of Lewis and Geschickter. In an overwhelming majority ocular complications, especially metastases in the orbit, occurred first on the side corresponding to the seat of the adrenal tumor.

The clinical picture is quite characteristic, though the symptoms vary, and are not all found in every case. The common features are: paleness, irritability, and complaints about pains in the extremities, then discoloration of the eyelids, uni- or bilateral, swelling about the bones of the skull, proptosis of one or both eyes, rapid progress of the anemia, and decay, the more rapid the younger the patient is. In many cases of this Hutchinson type, the existence of an abdominal tumor cannot be proved by clinical examination and is found only at autopsy.

Exophthalmos, the most striking and alarming symptom, may extend to such an extreme degree that the cornea is destroyed by ulceration, because the lids do not cover it. Tileston and Wolbach[17] describe a proptosed globe which almost entirely left its socket, being pushed outward, downward, and inward, so that it nearly touched the nose. Muscle rotations are often limited or impossible, the optic discs choked, the pupillary flexes absent, the vision defective or destroyed, but all these features may be absent. The papillitis may be due to two factors: the compression of the whole brain with pressure on the ventricles, and the compression of the optic nerve by the orbital tumor which is also the cause of the proptosis. Seefelder[18] reports that in his case the superior orbital fissures and the regions of both optic foramens were filled out with tumor tissue and both optic nerves were as if walled-in by it. In the case of Cohn[19] the orbital tumor broke through into the maxillary cavity and the hard palate, in Lederer's[19a] case the mass in the orbit was also in continuity with the superior maxilla.

The orbital tumor is not clinically evident in every case, but it sometimes becomes visible, bulging the eyeball in a certain direction or, as in Hill's[20] case, pushing the lower lid out several millimeters. In other cases, a distinct tumor soft tissue was felt in the orbit (Wessely,[21] Quackenboss,[22] Lederer, and other authors). Quackenboss, in 1910, proved the existence of a metastasis to the orbit at biopsy; Hill, in 1929, made the diagnosis of a probable neuroblastoma metastatic from the adrenal by removing and examining the orbital growth in a child, three months before a mass in the region of the involved kidney became palpable. Tileston and Wolbach (1908) and Platt[23] (1911) found orbital tumors by autopsy, but they took them for metastases of adrenal sarcoma. After these, several other authors proved by autopsy the evidence of orbital metastases in adrenal neuroblastomas. Wessely, who in 1919 erroneously claimed to be the first author to write about orbital metastases in adrenal neuroblastoma, found the lacrimal gland in his case imbedded in the orbital growth and appearing slightly hypertrophic. After removal it was found involved with tumor-cell conglomerates spread among the lamellae of the bone. In Leinfelder's second case the lacrimal glands were also found enlarged. Lagophthalmos, with the possibility of actively closing the lids for defense, was seen in a case of Coppez, Simon, and Claes;[24] ptosis, however, in Seefelder's case. As another rare feature, Smith[25] described a remarkably rapid growth of the eyelashes in a 17-months-old child. Lederer saw facial paralysis developing during hospital observation. The enlargement of the head, which together with secondary anemia and cachexia belongs

to the most outstanding symptoms in this disease, is due to the increased intracranial pressure (hydrocephalus) and in part also to local metastases bulging the bones of the skull.

The roentgenogram showed a characteristic picture in the cases of Lederer, of Askin and Geschickter, and of Leinfelder, consisting in hydrocephalus with wide separation of the cranial sutures and osteoporosis in the bones of the skull, pelvis, and in the long bones, and in Lederer's case orbital processes in the frontal bone. But in the examples of Wessely and of Coppez, Simon, and Claes, the orbits appeared normal upon X-ray illumination, though orbital metastases became evident by biopsy and autopsy, respectively. This phenomenon is easily understood on consideration of the softness of the tumor, which makes it sometimes appear like a hemorrhagically infarcted tissue. While opening the orbital cavity, Wessely found a spongy, vascular tissue which collapsed, discharging masses like clotted blood. Even two operations, by which tumor tissue was removed and microscopically examined, could not completely clear up this case as long as the child was alive. According to Seefelder the extension of free bleedings in bone metastases not infrequently passes that of the tumor masses themselves. He regards the ecchymoses in the lids are carried away from the bleedings in the bone metastases.

The diseases for which adrenal neuroblastoma may be mistaken are (1) infantile scurvy, which causes ecchymoses and proptosis; (2) chloroma, which shows unilateral proptosis and tumors about the skull; (3) acute rheumatism in cases accompanied by fever and pains in the extremities or joints; (4) myeloblastoma, (5) lymphoma, and (6) lymphosarcoma.

In nearly all cases therapy was without any lasting success. Lehmann,[26] who, in 1916, made a complete excision of the tumor in his 11-months-old patient, reported him well 15 years later. Since then other patients have been successfully operated upon, but those cases evidently are extremely rare, for, almost always, the growth has already metastasized into the body at the time of the first medical examination. Temporary recession of the ocular symptoms occurs after surgical treatment (Wessely) as well as after roentgen-ray therapy (Leinfelder), but only to become worse shortly afterwards, than it was before. Hill dissected the orbital tumor in capsule easily and completely, nevertheless death occurred three months later. Seefelder declares any operative treatment of the orbital condition as distinctly contraindicated. Askin and Geschickter found that irradiation with X rays or radium did not alter the speed of metastases, and that surgical intervention was followed by death within a month in nearly one half of their cases.

Report of a case

Charles S., aged 2 years and six months, first came to our office on June 17, 1935. About two months previously he had had an acute infection of both eyes, accompanied by swollen lids and purulent discharge. His right eye eventually cleared up, but in the left the eyelids remained edematous. The eye gradually became more prominent. The discharge did not clear in the left eye nor did the eye recede.

Examination then showed the left eye considerably proptosed and the globe fixed; also considerable thickening of the tissue over the left axilla (fig. 1). The pupil was small, dilated, and did not react to light. There seemed to be no tenderness, redness, nor signs of inflammation. The disc was pale. It was impossible to make a detailed fundus study, due to the lack of coöperation. An immediate enucleation followed by X-ray treatment

was advised, but the parents refused.

X-ray examination (Dr. C. W. Rauschenbach) June 18, 1935: "There is normal development of the cranial bones of the skull. There is no evidence of an osseous or opaque tumor to be noted in either orbit. The frontal sinuses are absent. Both ethmoidal sinuses and both maxillary sinuses are normal. The patient is noted to have an exophthalmos in the left eye, but there is no evidence of any bone lesion, and I therefore conclude that this must be the result of a soft tissue tumor. There is normal dental development."

On August 19, 1935, the patient returned and there was found to be a tremendous growth in and around the left orbit (fig. 2). The globe was luxated before the interpalpebral fissure, there was a tremendous chemosis of the conjunctiva, and the cornea was ulcerated. The optic disc was not very pale, the

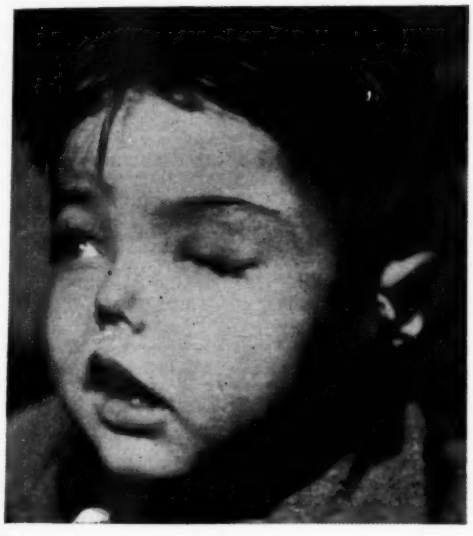

Fig. 1 (Kuhn). Appearance of eye on June 17, 1935, on admission.

retina was normal, and there was no pigmented area. On August 22, 1935, consent was finally given, and the eyeball and orbital contents were completely removed up to the apex of the orbit. The parents were given little hope for the child's recovery. A week later there was edema in the right disc and retina which seemed to interfere very considerably with the patient's vision.

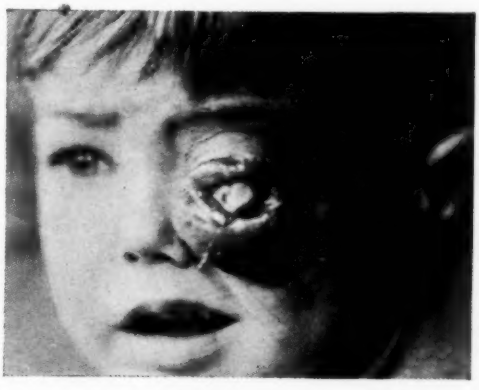

Fig. 2 (Kuhn). The eye on August 19, 1935.

Pathological report (Dr. Frederick H. Verhoeff) September 3, 1935: "The tumor of which you sent me a section now shows so little differentiation that I cannot be sure as to its origin. Its appearance, however, is consistent with that of a neuroblastoma arising from the adrenal, so that this is the most probable diagnosis. In any case, I feel sure that the tumor is metastatic in origin." From the Army Medical Museum came the following report on September 9, 1935. "We made preliminary paraffin sections in the case of C. S. and find a malignant tumor in the orbital tissue outside of the eyeball. Because of the fact that the eye had been opened it was impossible to make a satisfactory gross examination of the structures within the eye, and we will have to wait until the microscopical sections are finished before we can make any statement concerning the origin of this tumor. The cytology, however, is somewhat like that of neurocytoma, a malignant tumor which usually arises in the adrenals and metastasizes quite widely. We would appreciate some more information concerning the possibility of there being an

intra-abdominal tumor in this case. Meanwhile, the celloidin sections are being prepared. This will require a period of approximately two months time."

November 14, 1935. The patient gradually failed, a large mass of hard glands developing in front of the left ear and in the neck on this side. The orbit had filled with proliferating tissue in six weeks, but there was not much bulging forward from it. A swelling in the face of the maxilla was breaking through into the soft palate, and there was a gradually increasing inanition. There was no demonstrable enlargement of the body.

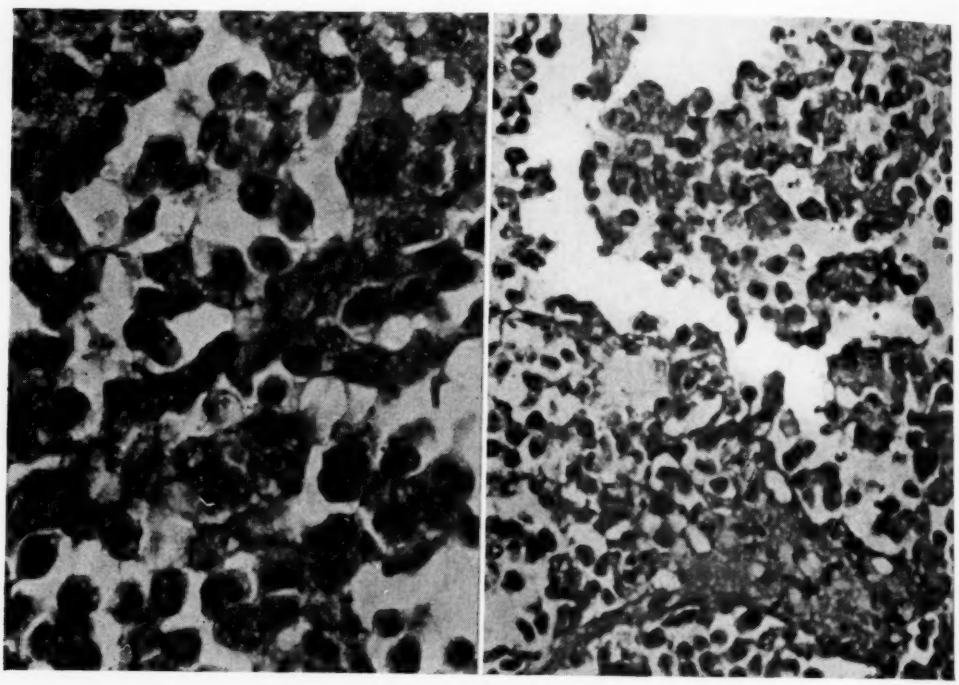

Fig. 3 (Kuhn). High- and low-power appearance of tumor tissue.

An X-ray examination (Dr. C. W. Rauschenbach) disclosed: ". . . a large soft-tissue tumor situated on the left side of the face. This tumor appears to have involved the neck and head of the left mandible and also appears to involve the left orbit, mastoid area, and temporomandibular articulation. It is noted to extend into the left orbital fossa. I am unable to make out any tumor mass in the abdomen. This patient's large intestine is greatly distended with gas pockets. The great amount of intestinal gas is noted to displace the diaphragm upwards. There is no effusion in either side of the thorax. There are no evidences of metastases in the bases of either lung."

On November 13, 1935, the patient died and an autopsy was performed. Permission to open the head was not, however, obtained.

Autopsy report

Head. The left eyeball and contents of the orbit had been removed previously at operation. A swelling on left side of the face extends from the left and involves the lymph glands situated over the parotid gland and submaxillary lymph glands. Large masses also are present in

the skin of the left cheek. The eye socket is filled with a friable, hemorrhagic tumor mass which on being incised, emits a chocolate-colored exudate. The masses over the cheek are rubbery in consistency and adherent to the deep structures. Several of the parotid lymph glands are about the size of walnuts, some of them adherent to each other. These are adherent to the deep fascia but not to the skin. The swelling begins about the left temple, extending posteriorly so as to push the pinna of the ear anteriorly. It extends anteriorly past the mid-line so as to involve the right eye. The nares are displaced upwards. The swelling displaced the palate down, pushing the teeth forward. The swelling of the palate involved the left side and extended slightly past the midline to the right. A large tumor mass, the size of a walnut, was also observed at the center of the forehead. The right eye was proptosed and partially fixed. Right parotid gland was also involved.

Chest. In the posterior portion of the pleural cavity, at the level of the eighth rib, there was a mass the size of a walnut which seemed to arise from the bone and was covered by pleura. The outside of the mass was smooth in consistency, adherent to the rib. When the mass was incised, a jellylike material exuded which was chocolate colored. Another similar mass was present in the right pleural cavity at the level of the second rib anteriorly. The pericardium also had similar masses about the size of walnuts, and of the same consistency. The heart and lungs were normal.

Abdominal cavity was normal.

Right Kidney was normal in size and consistency; no tumor masses were associated with it.

Left Kidney. A large tumor mass extended from the adrenal gland to cover the anterior surface of the kidney. The mass was the size of a chestnut and friable in consistency.

Histopathologic study. The greatest part of the orbital space is replaced by a tumor which reaches close to the globe and which infiltrates the ocular muscles and the orbital fat in strands. The muscle fibers near the tumor become smaller, break, and lose their cross stripes; between the fibers are hemorrhages.

The tumor consists mostly of small round cells. Between them can be seen some larger ones with greater nucleus and less chromatin substance. Some of them look like nuclei of ganglion cells. Mitosis appears in a few spots and, in some places, karyolysis.

The cells lie very tight and have a little fibrillar intercellular substance. The cells have a fair amount of protoplasm; there are basophile granula in some of them. There are a few rosettes, and several hemorrhages in the tumor.

Conclusions

As is seen by the literature, reports of cases of adrenoblastoma with autopsies are very rare. In our case the ocular symptoms clinically resembled those that Hutchinson described as a significant group. The remarkable thing in this case is the tumor, which could not be located clinically but was first found at the autopsy located in the left adrenal. The tumor of the orbit, as is usual, was on the same side. In the X-ray examination, it appeared as a tumor of the base of the cranium with destruction of the bony orbit and its adnexa, especially the mandibular joint, forcing forward the eyeball.

After removal of the orbital tumor the child was for a time in better condition, but he soon developed cachexia and died. The literature also indicates that removal of the tumor or treatment with radium or X ray has a good influence on the pa-

tient's general health, but that a permanent result has never been obtained. Until now only radium or X-ray treatment of the primary tumor has been attempted. It has never before been removed surgically.

It was very difficult to arrive either clinically or histologically at the correct diagnosis. Differential diagnoses to be mentioned are sarcoma and retinoblastoma. In their arrangement, the round cells resembled a round-cell sarcoma, and this diagnosis was made first, but soon corrected, and the tumor was identified as belonging to the group of tumors of the nervous system. The cells contained relatively much protoplasm, and there was hardly any intercellular substance. Larger cells were present, especially the ganglion type of cells and some rosettes. These findings led to the diagnosis of a neuroblastoma. As the eyeball and the optic nerve were not primarily affected by the tumor, but only secondarily, only a neuroblastic tumor could have been present, the origin of which is nearly always the sympathetic nervous system.

The clinical events and the autopsy finally confirmed these conclusions.

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CULTIVATION *IN VITRO* OF HUMAN CONJUNCTIVAL AND CORNEAL EPITHELIUM*

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New York

Tissue culture has found wide application in the study of viruses, not only in securing their propagation outside the body, but also as a means of studying their properties, in particular their effects on cell reactivity and morphology (inclusion-body formation). Chick-embryo tissues are most conveniently obtained, and have been found to support the growth of most viruses, even those that are incapable of infecting the adult chicken. Certain viruses, however, are more fastidious in their growth requirements and have not as yet been cultivated. Among these are three that involve the eye; to wit, the viruses of trachoma, inclusion blennorrhea, and molluscum contagiosum.

In view of the strict epithelial localization of these viruses and their failure to infect the common laboratory animals, human epithelial tissues, conjunctival and corneal, were chosen for study as offering the most likely mediums for successful cultivation. When a review of the literature failed to disclose adequate data on the cultivation of these tissues, a search for a suitable technique became the first necessity. For this purpose Dr. Alexis Carrel, of the Rockefeller Institute for Medical Research, very kindly granted me the facilities of his laboratory, and I wish to express to him, to Dr. A. H. Ebeling, and to other members of his staff my appreciation for their very full coöperation.

The following report contains a description of the testing of various standard tissue-culture methods and the finding of a technique believed to be appropriate for the growth of the epithelial tissues in question.

METHODS

Selection of tissues. The surgical staff of the Institute of Ophthalmology furnished normal conjunctival tissues from patients of varying ages and from a wide variety of sites, the greater number coming from the bulbar conjunctiva. The corneal material was not so varied. Fetal cornea was obtained in a few instances, but most of the material was secured from corneas from which grafts had been taken for keratoplasty operations. The tissues were generally used within an hour or two of their removal, but excellent growths were still obtained with tissue refrigerated at from 6° to 8° C. overnight.

Sterilization of tissues. The fact that the conjunctiva and cornea are exposed surfaces suggested that there would be considerable difficulty in obtaining bacteria-free tissues, and in the preliminary experiments the tissues were passed through dilute Dakin's solution. It was soon determined, however, that in the majority of instances washing them in several changes of Tyrode's solution insured sterility.

Materials. The following standard solutions and mediums[1] were employed: Tyrode solution, 0.02-percent phenol red in Tyrode solution, human serum, embryo extract, and chicken plasma.

The Tyrode and phenol-red solutions

* From the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University, and the Institute of Ophthalmology, Presbyterian Hospital, New York. Aided by grants from the Proctor Fund and the Committee on Scientific Research of the American Medical Association. Read at the Seventy-fourth Annual Meeting of the American Ophthalmological Society, at San Francisco, California, June 9-11, 1938.

were made in triple-distilled water and sterilized by passage through Berkefeld N filters.

In order to secure clear plasma the roosters from which the plasma was obtained were not fed for 24 hours before being bled. Chilled paraffin tubes were used to prevent coagulation. Human serum was obtained in the same way from subjects who had fasted at least 15 hours.

The embryo extract was prepared by diluting minced washed eight-day chick embryos with 0.25 c.c. of Tyrode solution per embryo. After centrifugation the supernatant fluid was drained off and stored in small tubes.

Carrel D 3½ flasks and microflasks of Pyrex glass were employed.

1. Plasma-clot technique

Plasma-clot cultures made in Carrel D 3½ flasks by the Carrel method proved successful. The medium employed was prepared as follows:

0.25 c.c. chicken plasma, diluted 1: 2 with Tyrode solution.
0.25 c.c. phenol red (0.02 percent) in Tyrode solution.
0.50 c.c. human serum.
1 capillary drop embryo extract.

Five small squares of tissue, cut with a cataract knife, were placed in each flask. Dilute chicken plasma rather than human plasma was used because of its greater resistance to liquefaction. It seemed to have little if any inhibiting action on the human tissue.

In successful cultures a slowly developing epithelial growth, preceded by a migration of wandering cells, was usually visible after 24 hours' incubation at 37°C. Fibroblasts began to appear in about 48 hours, and eventually overran the epithelial growths.

Epithelial tissues were found to grow somewhat better in small dilute plasma clots with superadded medium: A few drops of diluted chicken plasma (1 part to 2 parts of Tyrode solution) were placed in the flask, and then the squares of tissue and 1 drop of embryo extract added. When a clot had formed, 1 c.c. of medium (0.5 c.c. human serum; 0.25 c.c. Tyrode solution; and 0.25 c.c. 0.02-per-cent phenol red) was added; the pH was adjusted to approximately 7.4 with a gas mixture consisting of 3 percent CO_2, 21 percent O_2, and 76 percent N_2. In this medium the first extension of epithelial cells was observed in a few hours, and good growths were often obtained within 24 hours.

2. Semifluid technique

In this method a drop of dilute chicken plasma was pipetted into a D 3½ or a microflask and spread over its surface. Five or six squares of tissue were then placed in the flask and a drop of embryo extract added. After thorough mixing the excess plasma was drawn off until just enough remained to attach the tissue to the glass. After a period of five minutes or longer the usual medium (human serum, Tyrode, and phenol red) was added and the pH adjusted to 7.4.

This method yielded a high percentage of epithelial growths (29 of 38 attempts), and the rate of growth was considerably more rapid than in the plasma-clot cultures. The cultures maintained themselves well and could be washed and their medium changed without damage. This method, indeed, seemed well suited to most purposes, and in morphologic studies was far superior to the plasma-clot method on account of the better staining properties of the growths obtained with it.

3. Fluid technique

In this technique the usual medium (human serum, Tyrode, and phenol red) was used without the addition of plasma. The squares of tissue were placed, with proper spacing, into the flask containing the medium, and the flask was left un-

disturbed for at least 48 hours in the incubator at 37°C. In successful cultures the tissue settled to the bottom of the flask and the epithelium grew out over the glass. The growths were poor compared with those obtained with the semifluid technique, but this was doubtless due, in part at least, to unfavorable laboratory conditions. The sensitivity of developing tissues to vibration is well known, and during the period of this study the laboratory was subjected to a great deal of vibration from building construction near at hand. In the absence of vibration the technique might well have been more successful.

Staining techniques. Two satisfactory staining methods were utilized—the hematein-and-eosin method described by Rhodes,[2] and the Giemsa method. The former was the better for cultures in thick clots, since the clot itself stained but faintly, but for thin clots or fluid or semifluid cultures the Giemsa method was much to be preferred.

In the Rhodes method the flask to be stained, after removal of the medium and several rinsings with Tyrode solution, was filled with hematein solution (absolute methyl alcohol, 15 parts; glacial acetic acid, 1 part; formaldehyde (40 percent), 2 parts; and Mayer's acid hemalum, 1 part). After standing for 10 minutes in this solution the flask was rinsed carefully with methyl alcohol and then with tap water; partial dehydration with absolute alcohol followed, and counterstaining with alcoholic eosin for one minute. The culture was then washed in absolute alcohol and flooded with xylol until dehydration was complete. It was then ready for examination.

By the Giemsa method the culture to be stained, after removal of the medium and washing with normal salt solution, was fixed for five minutes or longer with absolute methyl alcohol. The alcohol was then removed and the flask filled with a dilute Giemsa solution, prepared by mixing one drop of stock Giemsa with 2 c.c. of neutral distilled water. The staining process was continued for two hours or longer, according to the strength of the stock Giemsa employed; the stain was next removed and the culture rinsed in distilled water. It was then ready to be examined.

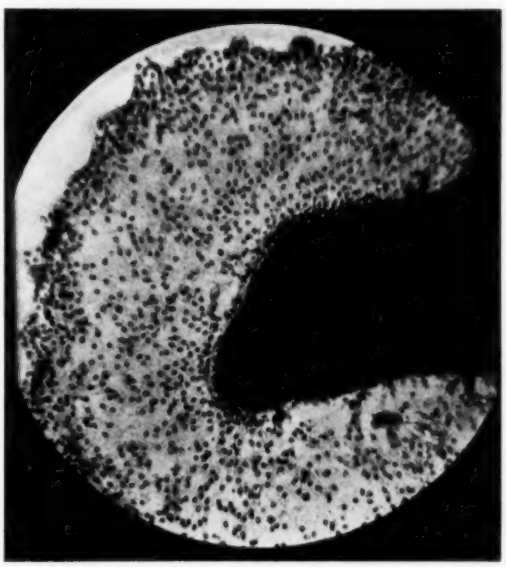

Fig. 1 (Thygeson). Thirty-six-hour growth of epithelium developing from a conjunctival explant. Giemsa stain. (× 150.)

Fluid cultures can be allowed to dry and will keep well. Cultures having a plasma clot must be examined while they are still moist; if they are allowed to dry, the clot cracks and becomes opaque. Permanent preparations could be prepared by washing in alcohol, dehydrating in xylol, and mounting in cedar oil.

Characteristics of conjunctival epithelium growing *in vitro*

Epithelial cells from conjunctival explants grew out in continuous sheets (fig. 1), and at the end of 48 hours formed an extensive growth, usually

Fig. 2 (Thygeson). Fifty-six-hour growth of conjunctival epithelium, showing multilayer development at periphery. Giemsa stain. (× 150.)

Fig. 3 (Thygeson). Extensive growth of conjunctival epithelium, showing formation of dihiscences in the membrane. Giemsa stain. (× 150.)

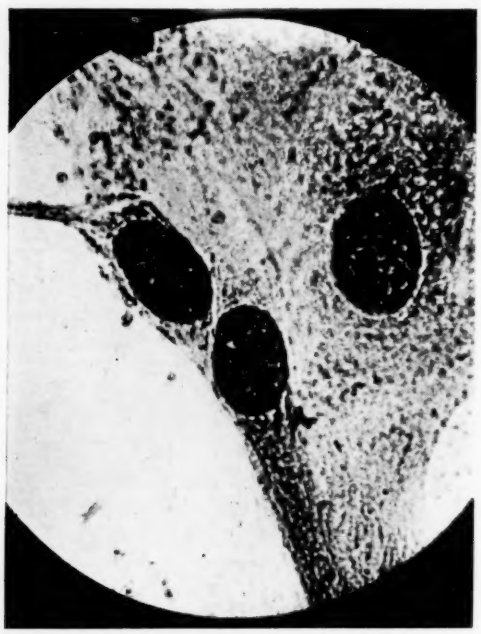

Fig. 4 (Thygeson). Epithelial cells at edge of new growth. Giemsa stain. (× 1750.)

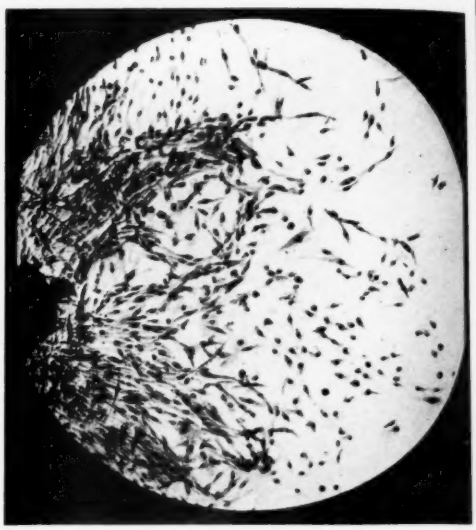

Fig. 5 (Thygeson). Fibroblasts developing from a conjunctival explant. Giemsa stain. (× 150.)

single layered. As the culture aged, secondary changes in the type of growth appeared. These consisted in a heaping-up of the cells at the periphery (fig. 2) —sometimes quite marked—and in the formation of dehiscences in the membrane (fig. 3). Thus in old epithelial cultures the growth sometimes formed a syncytium rather than a membrane.

When the cells were observed with

×60 water-immersion objective and ×15 ocular in D 3½ flasks, or with ×90 oil-immersion objective and ×15 ocular in microflasks, they appeared to be somewhat more granular (fig. 4) than epithelial cells taken directly in scrapings from the conjunctiva. This difference was less marked in young cultures (24 to 48 hours). There was often great variation in the size of the cells, some being extraordinarily large. In some cultures nuclear extrusions were common; in all cultures there was vacuolation of the cytoplasm in a number of the cells. Of considerable interest was the formation, in large numbers in fluid cultures, and in small numbers in semifluid cultures, of large multinucleate giant epithelial cells. No bodies that could be confused with virus inclusions were observed at any time.

Epithelial cells from conjunctival explants showed no morphologic differences with respect to their source, whether bulbar conjunctiva or upper fornix, nor did they differ in any material way from cells derived from corneal explants. The age of the subject from whom the explant was taken seemed to have no effect upon cell morphology or rate of growth of the culture.

Epithelial cultures appeared to have considerable resistance—although less marked than fibroblasts—to changes in the pH of the medium, to temperature changes, and to failure to change the medium at regular intervals. In two instances cells continued to grow for some time after the appearance of gross bacterial infection.

Characteristics of fibroblasts from conjunctival and corneal explants

Fibroblasts were always the third type of cells to grow out from the explants, succeeding the wandering cells and epithelial cells. They usually appeared on the third or fourth day, never before the second. Once it had begun, growth was always extremely rapid, the epithelial growth that had preceded it being quickly overgrown. Very extensive growths, spreading for many millimeters beyond the borders of the explant, were sometimes obtained (fig. 5). In splasma-clot cultures they could easily be transplanted, and representative strains were maintained for eight months and longer.

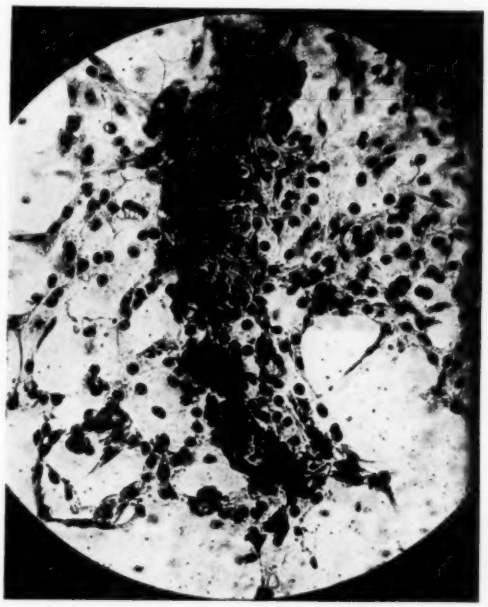

Fig. 6 (Thygeson). Corneal epithelium developing in pure culture from fragments of a bulla excised from a case of bulbous keratitis. Giemsa stain. (× 200.)

Pure cultures of epithelium

A pure strain of corneal epithelium was obtained in a culture made from the excised bulla of a case of bullous keratitis, kindly provided by Dr. Daniel B. Kirby. Growth developed (fig. 6) from all explants of this tissue, and consisted of pure epithelium without admixture of blood cells or fibroblasts. Epithelium free from fibroblasts was also obtained in

semifluid cultures in which the explants had become detached from the glass after epithelial growth had begun.

Comment

Of the three techniques outlined, the semifluid technique appears to be the one best adapted for the virus studies. It has the advantage over the fluid technique in that a much higher proportion of successful cultures are obtained, and is preferable to the plasma-clot technique in that the staining properties, particularly with the Giemsa stain, are much better. The Carrel D 3½ flasks are best for all ordinary work, since they allow examination with magnifications (with water-immersion lens) up to 900 times, sufficient for most inclusion-body studies. When higher magnification is desirable, the Carrel microflasks are valuable, although they are less convenient to work with.

Summary and conclusions

The cultivation of human conjunctival and corneal epithelium *in vitro* is reported, with notes on the histology of the developing tissues. A technique is described which is believed to be suitable for use in the study of such viruses as may require human epithelial tissues for propagation.

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Discussion

Dr. Daniel B. Kirby, New York: I think that Dr. Thygeson is to be congratulated on the development of this method of cultivation of tissues from the human eye. Drs. Carrel and Ebeling have both spoken to me of their admiration of the progress which Dr. Thygeson has made in this research. I think it will be of further value in researches in cytology and in pathologic studies of other human-eye tissues. In 1927 Dr. Key gave me a specimen of an eye containing a melanosarcoma. I used a method by which the tissues were made to survive, and some of them multiplied in the process. The tissues survived for 10 days, and during that period it was possible to observe the characteristics of the various cells, and I believe that further research along these lines is possible.

Again I wish to congratulate Dr. Thygeson on his work.

Dr. Ramon Castroviejo, New York: I was particularly interested in the presentation of Dr. Thygeson, because he has brought out some points that had been the subject of debate. Dr. Thygeson has demonstrated that epithelial tissue cultivated *in vitro* gives origin only to epithelial tissue. In the same way, connective tissue can give origin only to connective-tissue cells.

In reviewing the literature on the histology of keratoplasty published by some French authors, I was surprised to find the statement that the connective-tissue cells developed in repairing corneal transplantation wounds originated from epithelial cells. This observation entirely disagrees with Dr. Thygeson's findings in cultivating tissue *in vitro,* and with my own microscopic study of corneal grafts, both in animals and in human beings. Like Dr. Thygeson, I found that

epithelial cells can reproduce only epithelial cells, and that connective-tissue cells were produced by preëxistent cells of the same nature.

Another point stressed by Dr. Thygeson in his article was that the growth of tissue cultures was the same whether the tissue was obtained from fetuses, stillborn infants, or adults. This observation also agrees with our clinical findings, in which corneal transplants obtained from stillborn infants acted in exactly the same manner as transplants obtained from adults' eyes.

Dr. Thygeson deserves to be congratulated for his very thorough and most interesting presentation.

TESTING FITNESS FOR NIGHT FLYING*

Speed of Change of Adjustment of the Eyes for Intensity of Light and Distance of Object

C. E. Ferree, Ph.D. and G. Rand, Ph.D.
Baltimore

As a part of the routine of night flying, the flyer must look back and forth from the comparatively highly illuminated cockpit and instrument panel to more distant outside objects under very low illumination. The ability to do this quickly and with a satisfactory discrimination of detail is, we are told, the most important visual qualification of a night flyer. It involves a change in the adjustment of the eyes for both intensity of light and distance of object. In other words, the night pilot has quickly to adapt from light to dark and back again to light as well as at the same time change his adjustment for distance from near to far and back again to near. The time required for this combined action in a suitable test relationship can be measured with an instrument which we have variously called a multiple-exposure tachistoscope, an oculomotor and accommodation tachometer, and an instrument for measuring the dynamic speed of vision, speed of accommodation, and ocular fatigue. Pictures of this instrument were shown in a previous article.[1] Since that article was published, a new and much more convenient instrument, which we shall call a multiple-exposure electrical tachistoscope, has been designed and is now being manufactured by the Gaertner Scientific Corporation. Pictures of this instrument are given in figures 1 and 2.

The instrument comprises a timing mechanism and three shutters, electromagnetically operated, so arranged as to expose in immediate succession a near test object on the left, a far test object in the median plane, and a near test object on the right. The test objects are a letter E which can be rotated to four different positions to give an objective check on the judgment. The far test object is mounted in the same cabinet that contains the near test objects, the shutters, and the timing mechanism, as is shown in the sectioned side elevation (fig. 1). A front surfaced mirror that is mounted at an appropriate distance from the rear of the cabinet serves to reflect into the viewing slit the image of the far test object, thus reducing floor-space requirements. The distance of the far test object and the lateral separation of the two near test ob-

* From the Research Laboratory of Physiological Optics.

jects can be varied at will. Both the near and the far test objects are indirectly illuminated by a single long tubular lamp which is adjustably mounted so that the illumination of all the test objects may be equal or not, as the test conditions may require. The illumination of the front panel should be the same as that of the near test objects. Illuminations up to 10 ft-c. are readily available.

The shutters are mounted on light aluminum arms that are attached to the armatures of three relays suitably positioned in the cabinet. The operate and release times of each relay are of the order of 0.005 sec. On the outside of the cabinet the necessary switches are provided and a timing dial the pointers of which contact a commutator. The dial has 500 divisions each one of which is equal to 0.01 sec. when the commutator rotates at 12 r.p.m. By setting the pointers at the correct position on the dial, the operator may vary the exposure time of any test object at will, provided that the total duration of all the exposures does not exceed the period of one revolution of the commutator (in the above case, 5 sec.). The commutator is driven by a 1/80 h.p. universal-governor-controlled D.C. motor with double worm-gear reduction. By varying the speed of the motor the commutator can be given a range of speeds from 6 to 30 r.p.m. The total duration of all the exposures can therefore be varied from 10 to 2 sec. At these limiting ranges the divisions on the dial will equal respectively 0.02 sec., and 0.004 sec. If still longer total exposure times should be required, this can be arranged for in the reduction gearing of the motor. When alternating current is used, a synchronous motor can be substituted for the governor-controlled motor and a rectifier inserted to convert the current supplied to the shutters.

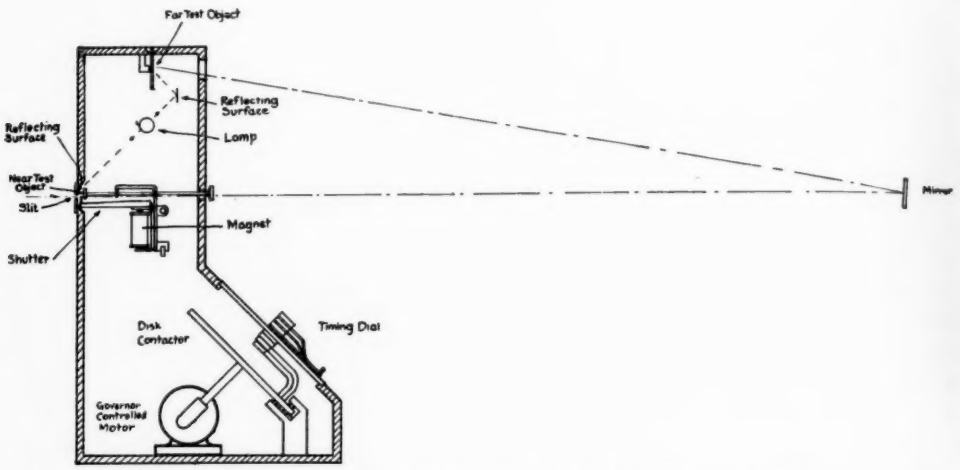

Fig. 1 (Ferree and Rand). Sectioned side elevation of multiple-exposure electrical tachistoscope showing the timing dial, the disk commutator, the motor, the exposure shutter and magnet, the viewing slit, the near test object, the far test object, and the lamp and the two reflectors for their illumination. The mirror is also shown in position for reflecting light from the far test object through the viewing slit of the cabinet.

This form of the instrument has been designed especially to give compactness of construction and the maximum convenience of operation.

The instrument makes possible: (a) the use of a set of very sensitive tests which

take into account as no other tests do both the motor and the sensory functions of the eyes in just the proportion that they occur in the act of seeing objects in different directions and at different distances, (b) the testing of the dynamic speed of vision with either the oculomotor or the accommodative feature emphasized, and (c) the measurement of the time required to change from near to far and from far to near in combination or separately.

tensity of light and distance of object. All that is required to make the additional measurement of speed of adjustment for change of intensity of light is obviously to illuminate the two near test objects to an intensity different from that of the far test object. The near test objects, for example, could be given an intensity similar to that illuminating the cockpit and instrument panel, and the far test object any suitable low intensity, preferably that approximating the outside illumina-

Fig. 2 (Ferree and Rand). The electrical tachistoscope in operation at a test station. The setup is for measuring speed of adjustment for change of distance of object.

The following practical uses of the instrument and test may be noted: (a) as a means of detecting abnormalities and depressions in the oculomotor functions in the work of the clinic, (b) as a test for vocational fitness in all cases in which dynamic speed of vision is an important requirement, (c) as a limiting test for age, (d) as a means of measuring ocular and oculomotor fatigue, also general fatigue, and the capacity to recover and (e) as a means of training eyes to greater oculomotor and accommodative facility.

It is the purpose of the present paper to recommend still another use of the instrument, namely, as indicated above, to measure the speed of change of adjustment of the eyes for both change of intention at night. To make this test the instrument should be installed in a dark or darkened room. A small curtained enclosure should be provided, the back wall of which is the face of the instrument. The enclosure will simulate the cockpit and will be illuminated to an intensity suitable for a cockpit. In this the examinee will sit. The face of the instrument will, then, have the illumination of the cockpit, which illumination should also be given to the near test objects. The far test object as seen in the mirror should receive the low amount of light that is selected as representing that of objects outside the cockpit. The test will then be performed in the usual manner. The time will be measured to discriminate the near

test object and to change the adjustment from the near to the far test object and back again to the near, both with respect to adaptation and muscle control. For this test a much larger far test object will have to be used than is employed for measuring speed of adjustment for distance alone under medium intensities of light. In this respect it may be noted: (a) that small objects could not be seen with the intensity of illumination and time of exposure that are provided, (b) that the objects which the night pilot is required to discriminate outside the cockpit are in the main large objects, and (c) that the time he has to make the discrimination is usually short.

It may be noted further that the test situation presented by the instrument is extremely favorable for the control of the preliminary adaptation of the eye. That is, the observer is seated facing the exposure shutters and the front panel of the instrument, which receive the same intensity of light as falls on the near test objects.* Thus in the natural course of the experiment he can very easily and conveniently be adapted for any length of time that is desired to the same intensity of light at which the experiment begins and ends; namely, the intensity usually found in the cockpit and on the instrument panel. The near test objects could of course be given any value of illumination that is wanted, also the far test object; that is, any experiments or series of experiments involving differences in the intensity of illumination of the near and far test objects over a wide range could be performed. Since in the instrument described, the total exposure time may be varied in continuous series up to 10 sec. or longer, the range of exposure times provided is ample for the purpose intended.

Obviously the test can be made in three ways: (a) The maximum performance for each person may be determined. This would be the analogue of making tests of visual acuity; for example, in terms of the minimum visual angle that can be discriminated. This procedure is the longest because it requires a correct adjustment of the exposure times for each observer, but it results in a much finer grading of performance. (b) Any suitable number of levels of performance may be chosen and the instrument set at once to give these levels. This method of testing would place persons in ranks or groups and is the analogue of the Snellen method of grading visual acuity. It is a quicker procedure than (a) but the grading is correspondingly rough. By a practiced examiner, testing by this method should take but a few minutes. In forming such a graded scale in our preliminary work with the instrument in general,[3] we used steps of 0.02 sec. for the double excursion. These intervals have been found very suitable by Comdr. C. J. Robertson (M.C.), U.S.N., in his work with the instrument in classifying aviators as to fitness of performance for day flying.[4] An alternate procedure would be to determine directly specific scales made up of the number and breadth of steps needed for the purpose in question. (c) Critical or limiting values could be established for any purpose for which such values are desired. The instrument could then be set for these values after the usual preliminary trials to familiarize the examinee with the test, and the determination made whether he could give the judgments required, which could be done with a single setting of the dials of the instrument.

The aforementioned three procedures are for a given intensity of light and given distances of the near and far test objects.

* A convenient means of illuminating the exposure shutters and the front panel of the instrument and of varying the intensity of illumination over a wide range as may be desired, is the device we have called a variable illuminator.[2]

The test can be varied indefinitely by changing these intensities and distances.

As stated in the beginning, the task set in this form of the test closely approximates that set for the night pilot in his routine performances—more closely than is the case, for example, in the tests recommended in two former papers;[5] namely, the determination of the light minimum and of the light minimum for the discrimination of detail. These were tests only of important general functions, not specific tests for particular performances; while in the new test made possible by the tachistoscope we have not only a scientific test of capacity, within the limits considered, but a specific performance test made under scientific conditions with accurate scientific controls. We call this a specific performance test because the actual visual task which the pilot has to perform in night flying is very closely copied. In this test his ability to make a quick adjustment for both change of distance of object and change of intensity of light is accurately measured. The time required for the change of adjustment for intensity of light of the order required here (the adaptation-time) is much more accurately measured, for example, than is possible with any adaptometer that has yet been devised. Only those who have done work on adaptation can appreciate how neat, quick, and perfect a way this instrument provides for measuring speed of adaptation. Light adaptation, for example, takes place so quickly that it is very difficult to measure it accurately with an adaptometer.

It may be stated further that the instrument employed also serves a very important purpose in the general testing program for aviators, as indicated earlier in this paper and in former papers[1, 3] and as has been shown in the extremely interesting and valuable studies made by Dr. Robertson[4] on the visual and oculomotor fitness for aviation and on the ocular and general fatigue induced in aviators. It is felt that further details with regard to the instrument and its uses are not needed here because of these previous papers by Dr. Robertson and by us in which full information is given.

Summary

As a part of the routine of night flying, the pilot must look back and forth from the comparatively highly illuminated cockpit and instrument panel to more distant outside objects under very low illumination. The ability to do this quickly and with a satisfactory discrimination of detail is perhaps the most important visual qualification of a night pilot. It involves a change in the adjustment of the eyes for both intensity of light and distance of object. The night flyer has quickly to adapt from light to dark and back again to light as well as at the same time change his adjustment for distance from near to far and back again to near. The time required for this combined action in a suitable test relationship can be measured with the instrument and test method described in this paper.

The task set by the method described closely approximates that set for the night flyer in his routine performances, more closely than is the case, for example, in the tests recommended in two former papers; namely, the light minimum and the light minimum for the discrimination of detail. These were tests only of important general functions, not specific tests for particular performances. The present test is not only a scientific test of capacity but a specific performance test made under scientific conditions with accurate scientific controls. Speed of adjustment for change of distance of object and change of intensity of light is accurately measured—that for change of intensity of light (speed of adaptation)

much more accurately than is possible, for example, with any adaptometer that has yet been devised.

The instrument described also serves a very important purpose in the general testing program for aviators and for testing ocular and general fatigue. Still further uses of the instrument are noted in the paper.

2609 Poplar Drive.

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NOTES, CASES, INSTRUMENTS

NEUROMYELITIS OPTICA

REPORT OF A CASE RESULTING IN BILATERAL TOTAL BLINDNESS

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A careful review of the literature reveals the fact that the syndrome usually recognized as acute retrobulbar neuritis —that is, an affection of the papillomacular bundle at any point along the second neuron and characterized by: first, an acute onset; second, unilateral incidence; third, central scotoma; and fourth, a tendency to recover—is a very common finding. The occurrence, however, of a lesion involving both second nerves with permanent loss of vision is extremely rare and therefore worthy of report.

In searching for the etiological factor in the reported cases of retrobulbar neuritis one is impressed by the tremendous variety of causes listed; almost every systemic disease as well as localized inflammations and toxic influences has been blamed for the ocular pathology. Some of the causes cited are syphilis, tuberculosis, arteriosclerosis, multiple sclerosis, encephalitis, diabetes, avitaminosis, neoplasm, typhoid fever, sinusitis, herpes zoster, alcoholism, thallium therapy, and many others.

Jaeger in 1931 reported a few cases of retrobulbar neuritis with marked loss of vision following influenza; he stated that these cases showed definite nerve atrophy followed by restoration of good vision. Uthoff, one of the first thorough students of ocular signs in multiple sclerosis, claims that 75 percent of retrobulbar neuritis is caused by multiple sclerosis, while other estimates range down to 28 percent.

Obviously the etiology of this syndrome, as gleaned from the literature of the past 20 years, is multiple and varied. Only 14 cases of acute bilateral retrobulbar neuritis were found in the reports of these years. These were cited by Charlin in 1936: of these, 12 of the patients were between the ages of 25 to 50 years, and two under this age; males were affected more than females in the ratio of ten to four. First one eye became blind, then the other followed speedily; pupils were dilated and fixed to light. During the first two weeks a mild swelling of the disc occurred in all cases, followed by pallor and restoration of vision. The author does not state how much vision was regained nor does he state the etiology of the cases, although implying that they were of influenzal origin or due to infection in the accessory nasal sinuses.

In a personal communication, Dr. V. Casten, of Boston, states that he has had five cases of acute bilateral retrobulbar neuritis in private practice during the past six years. The patients remained permanently blind and all were elderly people. There were no accompanying neurological signs, and the etiology was probably not of an infectious nature.

However, in contradistinction to this type of case, Allbutt in 1870, Achard and Guinan in 1889, and Devic in 1894 described a clinical entity in which there occurred massive demyelination of both optic nerves combined with the same type of lesion in the spinal cord, usually occurring in the lower cervical or upper dorsal regions, and to which the name neuromyelitis optica was given.

The pathology involved is an extensive demyelination of the nerve tissue with small areas of rarefaction in which the axis cylinders are also destroyed. There occurs marked perivascular infiltration of round and mononuclear cells

in the demyelinated areas, many of the cells being neurologic astrocytes.

This type of pathological change occurs, as has been said, in any part of each optic nerve in combination with the same type of lesion in the spinal cord, and it is to this group of cases that I wish to add my own case report. It is obvious that the amount of vision that will be regained by the patient will depend upon the amount of destruction caused by the inflammatory process within the optic-nerve tissue and will probably vary in every case. In previous case reports I have not been able to discover one case in which total blindness resulted, but because of the severe and extensive destruction of nerve tissue that occurred in my case, permanent blindness has ensued.

Case Report: W. F., a white, American, male, insurance agent, aged 34 years, was seen on January 12, 1938, at 11:00 p.m. He had suddenly lost the vision in both eyes, eight to nine hours previously. There had been a dull, nonradiating frontal type of headache during the previous few hours, but otherwise the patient had had no symptoms.

During the previous 10 days he had been treated by his local physician for a condition that was diagnosed as influenza. During this period of treatment he had received approximately 25 to 30 grains of sulfanilamide daily, and during the past two days had been up and about and tending to his work.

Examination upon January 12, 1938, revealed the vision in both eyes to be nil. There was moderate orbital pain upon movement of the eyeballs in any direction and slight pain upon pressure upon each globe. The lids, conjunctiva, corneae, lacrimal apparatus, and muscular excursions were normal. There was no congestion of either eye. The pupils were moderately dilated, about 5 mm. in size, and fixed to light and accommodation. The media of each eye were clear. Both optic-nerve heads were blurred with complete obscuration of outline. There were diffuse scattered hemorrhages over each papilla and over the peripapillary retina of each fundus, which area was edematous and ischemic. The veins were tremendously engorged and tortuous and the arteries were slightly constricted. A diagnosis of acute bilateral retrobulbar neuritis was made and the patient was immediately hospitalized.

Upon closer investigation of the past history no association with alcohol, drugs, lead, or serum could be elicited. The patient smoked about 30 cigarettes daily and was on a fairly well-balanced diet.

The eye condition remained unchanged during the next 48 hours and during this time the patient was seen by a neurologist. There were no clinical signs of additional neurological involvement at this time, but examination of the spinal fluid revealed the presence of 110 lymphocytes and 10 mononuclear cells; the total protein content of the spinal fluid was elevated to 45 mg. per 100 c.c. Roentgenograms of the skull and sella turcica were normal; the sinuses were negative. No other abnormal findings were found upon complete laboratory and clinical studies.

As most cases of retrobulbar neuritis that are not due to multiple-sclerosis have no abnormality of the cerebrospinal fluid, the patient was kept under careful observation by the neurological consultant, and daily lumbar punctures were made. The number of cells present in the spinal fluid continued to remain exceptionally high, varying from 70 to 120 in number, largely lymphocytes in type.

Upon the fourth day after admission to the hospital, the patient developed a motor-sensory paralysis of the bladder, with moderate distension and inability to void. The patient was placed upon tidal drainage upon the sixth day following

admission and regained no bladder function during the ensuing four days. During this time the optic-nerve heads became slightly less blurred, with some diminution in engorgement of the retinal veins. There was no improvement in vision nor in pupillary reactions.

Approximately 15 days after admission, during which time there had been complete paralysis of the motor and sensory function of the bladder for 11 days, the patient began to regain some sensation and function of the bladder, which increased comparatively rapidly. Upon the eighteenth day of his hospital stay, he had regained completely both motor and sensory bladder function, although there had been absolutely no change in the visual acuity. He was discharged on the next day (nineteenth day of hospitalization), the vision being nil in each eye.

He was seen again in my office one week later. There was marked recession in the amount of papillitis with a beginning pallor of the nerve heads. The veins were slightly distended and absorption of the retinal hemorrhages had taken place.

The patient was again seen one month later and was perfectly well physically but there was no change in his vision, which was nil in each eye; the pupils were moderately dilated and fixed. The optic-nerve heads were snow-white with a very small amount of new vessel formation about each nerve head, and the blood vessels had regained their normal size and shape.

This case demonstrates the course of an acute fulminating infection causing extensive destruction of the tissue of both second cranial nerves, which was accompanied by a lesion in the spinal cord that temporarily paralyzed the motor and sensory bladder function. The process in both cranial nerves was so extensive and severe as to produce permanent blindness; whereas the accompanying process in the spinal cord was of a milder nature, and complete recovery took place. The etiology is supposedly a virus infection.

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GUMMA OF THE OPTIC PAPILLA*

A CASE REPORT

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Few ophthalmologists have seen a gumma of the optic papilla, which is rather surprising in view of the frequency with which the optic nerve is involved in lues. Less than 20 cases are reported in the literature; however, such a possibility should be considered in any differential diagnosis of neoplasm of the papilla. According to Schieck-Brückner, the ophthalmoscopic picture is somewhat variable, "occasionally reminding one of a tumor; generally, however, giving the impression of a choked disc (fig. 1), often enough obscured by a clouding of

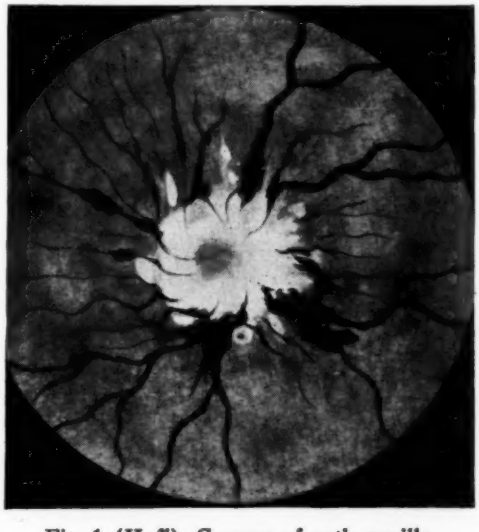

Fig. 1 (Koff). Gumma of optic papilla (from Kumagai).

* From the service of Dr. L. G. Hoffman, Illinois Eye and Ear Infirmary, Chicago.

the vitreous." Dimmer speaks of the tumor as cauliflowerlike, which fits the present case exactly. Frequent concomitant signs are an anterior uveitis, yellowish dots in the periphery of the fundus, and flame-shaped hemorrhages around the disc. Any or all of these may be present.

The ophthalmoscopic picture in this case is shown in figure 2 (printed from a

Fig. 2 (Koff). Ophthalmoscopic view of gumma of the optic papilla.

Kodachrome transparency by Dr. Robert von der Heydt), though necessarily a nonstereoscopic view does not fully demonstrate that this tumor projected forward into the vitreous for about five diopters. The figure shows clearly the atrophic portion of the retina adjoining the tumor and the high-grade perivascular sheathing which extended into the periphery of the fundus.

The tumor in this case was a glistening yellowish-gray, about 1½ D.D. in diameter, with a raspberrylike surface. It covered the lower temporal one third of the nerve head. The vessels coursed directly over it. The remaining visible portion of optic nerve was pale white with fuzzy borders. In the center of the gray atrophic portion of the retina about the tumor was a pink spot demarcating the macular area.

The patient was a known paretic with a four-plus blood Wassermann and spinal-fluid reaction. He had had tryparsamide and bismuth therapy at the Elgin State Hospital for the Insane. For about 1½ years preceding admission to the Illinois Eye and Ear Infirmary his vision had been failing but with no signs or symptoms of anterior-segment inflammation. There was no light perception in the eye with the gumma; the other eye had an optic atrophy with a corrected vision of 20/30 and a field as shown in figure 3. Slitlamp and other ocular examinations were negative, as was the general physical examination, except for luetic involvement of the nasal septum.

Differential diagnosis rests upon (1) serology of the blood and spinal fluid, (2) frequently associated inflammation

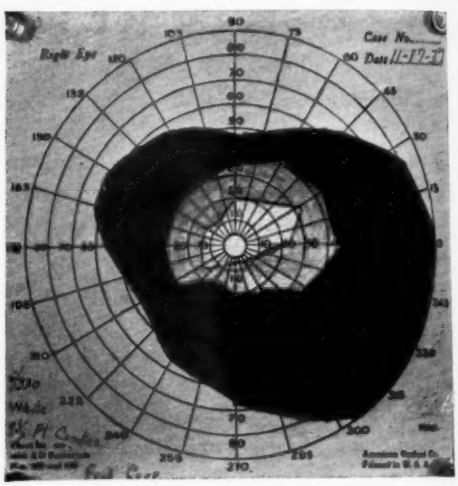

Fig. 3 (Koff). Visual field.

of the anterior segment, (3) above all the response to antiluetic therapy, the lesions regressing markedly and rapidly.

The functional prognosis is doubtful; some eyes may regain normal vision under strenuous antiluetic therapy, while others go on inexorably to total blindness.

Though there could be no histological

studies here, several of the reported cases have been verified by section (cf. Juler, Waggoner, Stock, Parsons, and Verhoeff). Verhoeff was able to demonstrate spirochetes in his case. The pathological basis of the lesion is a massive inflammatory process in the interior of the papilla with more or less necrosis. The gumma is commonly considered a lesion of tertiary syphilis, but in the optic nerve they may occur as early as three months after initial infection. Some have been observed while the skin manifestations of secondary lues were still present. Details of the reported cases can be found in the original articles listed in the bibliography.

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OPHTHALMOLOGICAL REQUIREMENTS FOR EMPLOYMENT—1939

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This material was compiled from circulars and letters received from various agencies, during the year. It has been arbitrarily limited for the sake of brevity.

United States Army, National Guard, and Organized Reserves (A. R. 40-105 and Circ. 74).*

Enlistment. 20/100 vision in each eye, 20/40 in one with glasses; no organic disease.

Commission. Army. 20/40 vision in each eye, 20/20 in one with glasses, ability to distinguish and identify red and green; no organic disease. *Medical* and *Chaplain.* 20/200 vision in each eye, 20/20 in one with glasses, if myopic; 20/50 in each eye, 20/20 in one with glasses, if hyperopic. Ability to distinguish and identify red and green; no organic disease. *National Guard, and Organized Reserves.* 20/200 vision in each eye, 20/20 in one with glasses. Ability to distinguish and identify red and green; no organic disease.

Standards for Flying (A.R. 40-110). Class #1, applicants, those in training, rated pilots, and combat observers. Class #2, rated pilots, and combat observers not meeting the standards of class #1, if permitted by Chief of Air Corps. Class #3, rated command pilots and technical observers.

Visual acuity: Class #1, 20/20 in each eye, without glasses. Class #2, 20/40 in each eye, 20/20 in each eye with glasses while flying. Class #3, 20/100 in each eye, 20/20 in each eye with glasses while flying.

Depth perception at six meters: Class #1, 30 mm. or less. Class #2, 35 mm.

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* Data in parentheses indicate the official number or title of the publication from which this information was compiled.

or less, with glasses. Class #3, command pilots only, 35 mm. or less.

Heterophoria at six meters: Classes #1 and #2, esophoria of 10^{Δ} or less. Esophoria of 4^{Δ} or less with prism divergence of less than 4^{Δ}. Exophoria of 5^{Δ} or less. Hyperphoria of 1.0^{Δ} or less. Class #3, esophoria of 12^{Δ} or less; exophoria of 7^{Δ} or less. Hyperphoria of 2^{Δ} or less. Any heterotropia for all classes.

Power of divergence: Classes #1 and #2 only. Divergence must equal or exceed esophoria not more than 15^{Δ} or less than 3^{Δ}.

Red-lens test: Classes #1 and #2. Diplopia at 50 cm. or more. Command pilots, diplopia at 27.30 cm. or more.

Inspection of the eyes and ophthalmoscopy: No permanent defect interfering with function.

Accommodation: Class #1, not more than 3 diopters below mean for age, or total of less than 6.5 diopters. Class #2, not less than 3 diopters. Classes #2 and #3, no restrictions if, while flying, near correction is worn that gives normal vision at 50 cm.

Angle of convergence:

$$\frac{1/2 \text{ Pd} \times 100}{\text{PcB}} + 3$$

(Pd = pupillary distance; PcB = near point of convergence.)

Classes #1 and #2, angle of convergence of 40 degrees or more.

Central color vision: Normal.

Field of vision for form: Normal for 3 mm. white test object at 33 cm.

Refraction: 1.5 diopters or less in any meridian, or cylinder of 0.5 or less, with cycloplegia.

United States Military Academy (Circular of Information).

20/20 vision in each eye without glasses; no organic disease; total hyperopia of 2^{Δ} in any meridian; esophoria of 10^{Δ} or less; exophoria of 5^{Δ} or less; hyperphoria of 1^{Δ} or less; and fair color sense.

United States Navy (Regulations).

Enlistment. 15/20 vision in each eye, 20/20 with glasses, normal color vision; no organic disease.

Commission. 18/20 vision in each eye, 20/20 with glasses, or when myopia or myopic astigmatism is present, normal color sense; no organic disease. *Staff Corps.* 12/20 vision in each eye, 20/20 with glasses, normal color sense; no organic disease. *Supply and civil engineers.* 15/20 vision in each eye, 20/20 with glasses, normal color sense; no organic disease.

United States Marine Corps.

Same as the Navy.

United States Naval Academy (Regulations).

20/20 vision in each eye without glasses, no myopia or myopic astigmatism; no organic disease; normal color vision. During service and at graduation, 18/20 in each eye without glasses and 20/20 without glasses when due to myopia or myopic astigmatism. Entrance examination under cycloplegic.

United States Department of Commerce. *Civil Air Regulations* (20 and 21).

Student, solo and private pilot. 20/50 vision in each eye, or 20/30 with glasses, depth perception 30 mm. or less, no diplopia or serious pathology.

Limited commercial, commercial, and airline. 20/20 vision in each eye without glasses, depth perception 30 mm. or less, no diplopia, normal muscle status with abduction of 3^{Δ} or more,

normal accommodation and fields of vision, no pathology, hyperphoria less than one.

Steamboat Inspection Service (801-A).

Master, mate and pilot. Certificate of visual competency and normal color sense. For renewal or raise in grade, normal color sense unless limited to daylight service.

Engineer. Certificate of visual competency.

United States Civil Service Commission.

Stenographers, typists and clerical workers (2313); *bacteriologist* (72), *elevator conductor* (18), *printer-proof reader* (22), *and customs examiner's aid* (27). 20/200 vision in one eye, 20/30 with glasses. Customs examiner's aid to have normal color sense.

Nurses (26, 27, 28, 68, 13, and 51). 20/40 vision in one eye, 20/70 in the other; with glasses, 20/30 in one eye, and 20/40 in the other.

Warders (20), *park rangers* (23), *stewards* (34), *cooks* (94), *and farm managers* (50). 20/40 vision combined, 20/50 in the weaker, without glasses.

Safety instructors (65), *and junior refuge managers* (84). 20/40 vision in each eye without glasses.

Marine surveyor (70). 20/30 vision in one eye, 20/200 in the other with glasses.

Assistant and associate refuge managers (85). 20/200 vision in each eye, 20/40 in each with glasses.

Student finger-print classifier (9), 20/30 vision in each eye, 20/20 in each eye with glasses, normal accommodation, normal color vision; no pathology.

Policeman (21). 20/30 vision in each eye, 20/20 binocularly, without glasses, normal color sense, and no pathology.

Marketing specialist (33), *inspector of clothing* (34), and *poultry inspector* (43). Normal color vision.

New York State Civil Service Commission.

Court attendant. Average 20/30 vision in both eyes, 20/40 in the weaker, with glasses.

Prison guard (79). 20/40 vision in each eye without glasses.

Patrolman (109, 73, 63, and 222). 20/40 vision in each eye without glasses.

Game protector (124). Tests for eyesight may be required.

Clerical. None.

Nurses. None.

New York City Civil Service Commission.

Clerical. 20/40 vision in one eye with glasses.

Skilled and unskilled labor. 20/40 vision in one eye with glasses, vision in the other.

Subway system. 20/40 or 20/30 vision in each eye, depending on the position. Glasses allowed, except for conductor, towerman, and yardmaster.

Prison keeper and auto truck driver. 20/30 vision in each eye, without glasses.

Life guard. 20/30 vision, both eyes together, without glasses. Vision in both.

Court and other attendants. 20/30 vision in each eye, with glasses.

Policemen and firemen. 20/20 vision in each eye, without glasses.

New York State Troopers.

20/20 vision in each eye without glasses.

New York State Motor Vehicle Bureau.

Operator and chauffeur. 20/40 vision in each eye with glasses.

Civilian Conservation Corps.

20/200 vision in each eye, 20/40 in one with glasses; no organic diseases.

253 Cumberland Street.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Section on ophthalmology
April 8, 1938

Dr. Walter Camp, *president*

Dry eyes

Dr. C. Wilbur Rucker of Rochester, gave a talk on this subject.

Discussion. Dr. Virgil Schwartz said that most of us have not seen much of this condition. He was interested to know if Dr. Rucker has any idea as to whether or not there is a connection between this and xerophthalmia. He said nothing regarding the possible cause of the trouble except in one instance, a history of generalized glandular inflammation. Does avitaminosis play any part in this condition?

Dr. F. N. Knapp, Duluth, reported that in a recent meeting at Cairo, Ida Mann was discussing cases of keratitis in ex-service men. These patients suffer from recurrent attacks after trench-gas burns. No treatment gave much relief until she began using a contact glass. With the use of the contact glass the corneal lesions are relieved rapidly and the pain and discomfort were alleviated.

Dr. A. D. McCannel, Minot, North Dakota, stated that he had had very little experience with this type of case, but he recalled one case similar to this. The patient had a marked photophobia, with small punctate areas of staining over the entire cornea. He treated the patient over a period of two years, at intervals of about three months. She was given palliative treatment, mild mercurials, dionin, and the trouble would clear up. In about three months she would be back again, with the same symptoms. After this had occurred several times, he advised her to seek further consultation, which she did, with practically the same results as before. Finally, she consulted an old doctor whom many of us knew in those days. He injected her upper lid, which gave her immediate relief, and she had no recurrence for a period of eight years.

Dr. Charles N. Spratt suggested that the keratitis in these dry eyes might be due to the absence of lysozymes. The protective action of this substance was demonstrated many years ago by Ridley. Lysozymes play an important role in protecting the cornea from infections.

Dr. Charles Hymes asked Dr. Rucker if he found evidence of mild iritis associated with filamentary keratitis and if the punctate keratitis of the limbus seen in elderly people is in any way associated with lack of sufficient tears. The fact that punctate keratitis of the limbus of the cornea clears up rather promptly after cauterization would indicate that an insufficiency of tears is probably not a factor.

Dr. Rucker in closing said that the keratitis sicca that he had described is not the same as early xerophthalmia, as suggested by Dr. Schwartz. When there is a deficiency of vitamin A, a keratinization of the corneal epithelium occurs and a hyalization of the superficial layers of the stroma tissue along with the dryness of the conjunctiva and the appearance of Bitot's spots. In the picture he described there were merely punctate ulcers on the cornea and small strands of epithelial filaments. Sjögren has shown that in a number of cases studied the sections of lacrimal glands showed evidence of a previous inflammation that had destroyed the gland cells and had replaced them with connective tissue. He

had not used a contact glass in treating any of these patients. As far as he knows there is no evidence that this clinical entity of dry eyes is caused by a deficiency of lysozymes in the tears, as suggested by Dr. Spratt. Neither is this disease related to the corneal ulcers appearing at the peripheral portions of the cornea in old people, as suggested by Dr. Hymes. As stated, these ulcers clear rather promptly after cauterization and treatment of the accompanying conjunctivitis. Such treatment is of no avail in the cases of dry eyes.

Divergence Insufficiency

Dr. A. D. Prangen, Rochester, presented a paper on this subject which was published in the May, 1938 issue of this Journal.

Discussion. Dr. Koch of Rochester said that the following remarks, as would be noted, necessarily were rather categorical and assumptive. The question of the existence of divergence as an active ocular function rather than as one of passivity had been discussed only infrequently in the literature. Bruce, in the Archives of Ophthalmology in April, 1935, offered an excellent review of this subject.

It must be granted that active divergence must exist in some degree if convergence is to be of biologic value. Normally, the two functions of convergence and divergence are antagonistic and one may assume, therefore, their phylogenetically simultaneous appearance, since nature tends to preserve and accentuate biologic assets.

As the eyes moved forward, phyletically, the visual fields overlapped and binocular stereoscopic vision ultimately developed. Points at varying distances can be focused by the visual axes in true fusion and both convergence and divergence are each in turn indispensable to this ability. If divergence is accepted as a function of importance and not as a mere factor in the ocular mechanism, there must exist a center to control its activity.

The center for convergence in the nucleus of Perlia is well established and is the last known center to have been differentiated in the phylum. It is difficult to believe that this very important center is without its physiologic antagonist, especially when one considers the phylogenetic development of convergence and its importance to fusion. By deduction, therefore, divergence must have appeared approximately coincident with convergence.

With the eyes in a state of convergence, lateral divergence can be accomplished only by two means—elasticity, and by contraction of the external rectus muscles. Elasticity accounts for very little of this divergence, the action probably taking place chiefly through the innervation of the external recti from the abducens nuclei or from some other source, supposedly, the nucleus for divergence.

The most positive evidence in favor of the existence of a divergence center is obtained from the study of the recognized clinical entity of paralysis of divergence. As Bruce has emphasized, the lesion would necessarily be in the cortex, the paths below the cortex, or in a divergence nucleus. Its location in one or both of the first two situations, however, would be of such extent as to cause marked prostration or even death; certainly, symptoms other than those of paralysis of divergence alone would predominate. Thus, the only situation left to be occupied by a lesion that would produce the picture of simple paralysis of divergence is the divergence center or nucleus.

Further confirmation is obtained from the fact that the abducens nucleus is unaffected in pure divergence paralysis but may become involved later, as in encephalitis, and produce true abducens-

nerve paralysis. Thus, from the foregoing, it is possible to assume that the abducens nerve regulates (in a sense) the function of divergence, making possible the postulation of a center for divergence separate from, but adjacent to, the nucleus of the abducens nerve. And, since the external rectus muscles are innervated ipsolaterally, this nucleus for divergence would probably lie in the midline above the nucleus of the abducens and the nucleus of Perlia.

Dr. Walter Fink of Minneapolis said that they were indebted to Dr. Prangen for bringing this subject to their attention, as these cases are not only interesting but that his presentation stressed also the importance of a thorough analysis of muscle cases. He believed that insufficiency of divergence, like divergence excess, to be uncommon, probably less than 1 percent.

It was his impression that cases of this nature, over a period of time develop convergence excess as a secondary complication. It is only by being on the lookout for it that cases of moderate degree can be recognized. Incorrect diagnosis may be made, and incorrect treatment in the form of muscle exercise may be given which will aggravate the condition.

In treating situations of this type it has been his custom to attempt to develop divergence by base-in exercise or the use of stereoscopic cards made by the Keystone Company. It has been his experience in using prisms that the amount of prism must be increased, and he has discontinued using them.

Dr. Hendrie W. Grant, St. Paul, said that in considering the subject of divergence insufficiency and convergent squint for distance alone, he believed one very important factor should be stressed; that is, the differentiation between an intermittent squint and a true phoria. With strabismus at one distance and phoria at another, changes may eventually take place in the muscle to produce strabismus to both distances; that is, far and near. Ordinarily, such convergent squint which is present for distance alone, and not for near, develops in the latter years of childhood when the tendency of the position of rest is esophoria. It has not been his experience that either children or adults can overcome a large amount of esophoria for distance without double vision, and that, ordinarily, four prism diopters of prism divergence is necessary to prevent double vision. Most of the individuals with this condition who have difficulty with close work have some involvement of the near point also from a constant squint. In older persons, disturbances which produce an esophoria for distance are essentially innervational and respond well to correction with prisms, and most satisfactorily so when the prism divergence can be increased to four diopters. He could see no reason why prisms should not be prescribed for individuals for whom this type of phoria develops late in life.

Dr. Prangen in closing said it is difficult, in a way, to see why the wearing of prisms, base out, particularly in both distance and near vision, should be of benefit in these cases. He believes the answer, however, is as Dr. Grant pointed out, that our discussion is limited to that definite group of older people who have an innervational type of disturbance exhibiting itself by a definite deficiency in the divergence mechanism. In these, in our experience, the use of the minimum amount of prism, base out, worn constantly has been of benefit.

Dr. Wheeler asked whether the use of atropinization and added plus lens in near vision would be of benefit in these cases of divergence insufficiency. In our experience, these were of no benefit except that therapeutic cycloplegia was of transient help in putting the eyes at rest but

did not alter the amount of esophoria exhibited.

In answer to Dr. O'Reilly, the question as to whether the nervous irritability exhibited by these people was the cause of the eye difficulty, or vice versa, we have been unable to determine which is the primary cause, the nervous instability or the ocular pathology.

George E. McGeary,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

May 9, 1938

DR. THOMAS D. ALLEN, *president*

IRIDOCYCLITIS WITH SECONDARY GLAUCOMA

DR. ROBERT FITZGERALD presented a Negro aged 21 years, who entered the hospital on October 11, 1937, with a severe attack of acute iridocyclitis and secondary glaucoma of the right eye of two-weeks' duration. The intraocular tension was above 80 mm. Hg (Schiötz). There was severe pain and the vision of the affected eye was reduced to ability to count fingers at 12 inches. The left eye was normal at this time, with visual acuity of 20/15. Following miotic therapy, combined with limbal paracentesis and subsequent daily drainage of the anterior chamber by reopening the wound, the hypertension was completely relieved and the anterior uveitis subsided. History and examination revealed only a chronic suppurative prostatitis said to be of two-years' duration, which followed an acute gonorrheal urethritis. No evidence of syphilis was found; the serology of the blood and the spinal fluid was negative, even after provocative arsenical injections. Tuberculin tests were negative and there was no clinical nor roentgenologic evidence of tuberculosis. No foci of infection were found in the teeth, tonsils, or nasal sinuses.

About five weeks after admission therapeutic massage of the prostate was started. After the initial massage, the right eye promptly developed a recrudescence of the anterior uveitis, without hypertension, and also a deep infiltration of the central portion of the cornea, followed by deep vascularization. The left eye developed an acute anterior uveitis, followed about four weeks later by a similar parenchymatous keratitis. During a period of some six months of treatment, the corneae have cleared until the vision has improved to R.E. 20/50, L.E. 20/40. No further signs of active prostatitis remain. Each prostatic massage was followed by temporary increase of ocular pain and blurring of vision.

The suggestion was made that in similar cases prostatic massage should not be too vigorously nor frequently applied. There were similar occurrences in two other patients with iridocyclitis due to prostatitis, who were under observation and treatment at the same time. Within 24 hours after vigorous prostatic massage, one patient developed marked exacerbation of the iritis with spontaneous hyphema; the second patient developed severe iritis in the previously unaffected other eye.

CONJUNCTIVAL TUMOR

DR. ROBERT FITZGERALD said the second patient, a Negro aged 55 years, entered the hospital on February 16, 1938, with a massive infiltration and tumefaction of the conjunctiva of the right eye which had been developing for two years, preceded for one year by secretion and redness without noticeable swelling. There was irregular nodular infiltration of this enormously tumefied conjunctiva, with several areas of ulceration. The upper and lower lids were overriden en-

tirely by the conjunctival mass, which extended upward to the eyebrow level, temporally well beyond the outer canthus, and downward to the lower margin of the orbit. The infiltrated conjunctiva was so tense that it could not be retracted upward as far as the margin of the lower lid. There was a deep lagophthalmic marginal corneal ulcer near the lower limbus. The Wassermann and Kahn tests on the blood serum were strongly positive, but the spinal-fluid serology was negative. On three occasions segments of the infiltrated conjunctival tissue were removed for biopsy and each time the pathologist reported tuberculous granulation tissue. Smears were examined repeatedly, with one finding of acid-fast rods resembling tubercle bacilli, but guinea-pig inoculation was negative.

The patient was placed on antisyphilitic therapy, daily mercurial-ointment inunction and potassium iodide. The conjunctiva was irrigated with 2-percent urea solution. Under this treatment improvement was rapid and at the end of five weeks the clinical cure was complete.

HUGHES OPERATION FOR PLASTIC CORRECTION OF LARGE DEFECTS OF THE LOWER LID

DR. W. F. MONCRIEFF said that three cases were presented to demonstrate the first stage of this operation. The first patient had a large flat condylomatous tumor mass with dark hemorrhagic crusted surface involving the outer two thirds of the left lower lid, extending downward from the lid margin to below the inferior margin of the tarsus. Histologic examination revealed a prickle-cell carcinoma. This had been present for six weeks prior to admission to the hospital. The tumor was removed surgically and plastic repair was made by means of the Hughes operation.

The second patient had a carcinoma involving the right lower lid, of six-years' duration. Following radium therapy three years previously, a slough of the entire lower lid occurred. Two attempts at plastic repair one year later were unsuccessful. At the time the present surgery was performed there was complete loss of the right lower lid with deep scarring and fixation of surface tissues to the lower rim of the orbit. The patient was shown about five weeks after the first stage of the Hughes operation had been performed.

The third patient had a carcinoma of three-years' duration, which involved the left lower lid. Despite rather large doses of radium administered intermittently over this period, the lesion continued to progress. The tumor involved the entire length of the left lower lid with a large ulcerated area in the midportion of the lid margin. About five weeks prior to this meeting, the entire area was resected and plastic repair by means of the Hughes operation was initiated.

These cases will be shown at a future meeting when the procedure is completed.

Discussion. Dr. Sanford Gifford said, with reference to the Hughes plastic operation, that several things not mentioned by Hughes in his article, have been learned. If his directions as to suture of the mucous membrane to the skin were followed, it was found that the conjunctiva was too short and that it turned the skin in with the lashes. In the second of the three cases shown, the conjunctiva was not sutured to the skin in the middle, but only a couple of stitches were inserted near the inner and outer sides. This prevented the conjunctiva from turning in the lashes. Hughes did not mention drainage. In one of these cases there was a great deal of secretion inside the sac, with profuse discharge. Some polyps developed where the tarsus was sutured to the lower lid. The profuse

purulent secretion cleared up when the lid was opened and the polyps were removed. In two cases the graft was taken from the brow, leaving a few hairs which acted as lashes.

Recurring pterygium treated by an epithelial corneal graft

Dr. H. W. Woodruff reported the case of L. K., a white man aged 41 years, who first consulted us on August 12, 1937, because of a corneal growth (pterygium) on the right eye. He had been aware of it for four years. It had first been treated with medicine by a general practitioner. In March, 1937, it had been operated on by a competent ophthalmologist, but had recurred. Six weeks later a second operation was performed, and it was cauterized. Later a further slight operation was done, the exact nature of which is not known. Recurrence followed after every attempt. Vision was reduced to 6/10, and the patient complained of blurring of vision. The apex of the growth reached the pupillary margin. On August 14, 1937, a McReynolds operation was performed. This, however, was also unsuccessful and the growth returned.

Coincident with this case of recurring pterygium, we had a case of complete corneal opacity in both eyes with symblepharon from an alkali burn. We were able completely to relieve the symblepharon by skin grafts taken from the arm, and we were waiting for a suitable case in which enucleation of an eye was required to furnish clear cornea for an attempt at transplantation. This case was forthcoming in the person of a 20-year-old boy, a patient of Dr. Harold Wadsworth, whose eye had been cut with a chisel. The wound was scleral and very extensive and caused prolapse of the globe. It was therefore thought feasible to attempt corneal graft in both the case with the opaque cornea and that with the pterygium.

The patient whose eye was to be enucleated (the donor) and the patient with opaque corneae, were anesthetized with avertin; the third patient with pontocaine. A 4-mm. disc was removed from the clear cornea of the donor before enucleation and placed in the previously trephined cornea of the recipient with the opaque cornea. As there was no available conjunctiva, an attempt was made to hold this corneal graft in place by a mucous graft from the lip. In this case there was complete failure.

A lamellar graft was removed from the same cornea of the donor with the Castroviejo cataract knife and placed upon the denuded corneal surface produced by removal of the pterygium. No attempt was made to hold this graft in place except by the closed lids. This was an immediate success.

In this case the corneal graft remained in place and remained clear for two months, following which a blepharitis developed with vesicles on the lid margin and the graft lost some of its transparency, which has not been regained. At present the graft is not entirely clear and the pterygium is in contact with the limbal margin of the graft. The conjunctival portion of the pterygium is very red.

The case cannot be reported as entirely successful as yet, but in view of the fact that corneal grafting is of great interest, this case may merit some discussion and consideration. Von Hippel, Elschnig, Castroviejo, Thomas, and others have done much, both experimentally and practically, to encourage corneal grafting in suitable cases. Is it not possible that epithelial or lamellar forms of corneal grafts may not be worth considering in cases in which the opacity does not extend through the entire thickness of the

cornea? We have in mind making such an attempt on the opaque cornea in the patient who sustained alkali burns.

Discussion. Dr. Harold Wadsworth remarked that the matter of getting the donor and the recipient together was quite a problem. When the patient with the chisel injury was seen, there was a completely collapsed eyeball. Dr. Woodruff advised filling the globe with normal saline. The cornea was not injured; there was a wound about 1 cm. in extent, just above it. The outcome was questionable, and the possibility of using the cornea was discussed. About three weeks after the injury the eye was blind and became atrophic, but the cornea was in excellent condition. While Dr. Harry Woodruff prepared the cornea, Dr. George Woodruff and Dr. Wadsworth enucleated the eye of the patient in the other room, and just before the graft was taken, the globe was again filled with normal saline.

Dr. Elias Selinger said that the difficulty of getting a donor can be overcome in cases where a partial, nonperforating corneal graft was to be used, by employing an autotransplant. About six years ago he saw Dr. Magitot use a very fine gouge to remove the opaque portion of the cornea in a patient with pterygium and, with the same instrument, remove a similar sized piece of clear cornea from the upper half of the cornea and cover the defect with it.

Dr. W. F. Moncrieff recalled a case of pterygium seen about five years ago. Two or three operations had been performed. Each recurrence was worse than the last and the growth became very thick. A skin transplant was made, covering the sclera as well as the cornea. While the graft prevented recurrence of the pterygium, there were different places where vascularization of the cornea took place. This was controlled with radium therapy.

Dr. Harry Woodruff (closing) said he had hoped there might be something said by some of the expert pathologists regarding the etiology of pterygium. To him it had always been a most mysterious and uncanny occurrence. In a certain few cases it continually recurred in spite of whatever type of operation might be used. It would seem that the term malignant might be applied to some of these cases so far as the pterygium itself is concerned.

In the case presented, he was not at all sure at this time that the corneal graft would act as a barrier to prevent the pterygium from pushing its way through. It was rather early to say, but he was anxious to present the case to see what other members thought of the possibility of a corneal graft in recurrent pterygium, and also the use of the lamellar graft in certain other cases of corneal opacity.

Robert Von der Heydt.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

September 26, 1938

Dr. Clifford B. Walker, *president*

Sulfanilamide treatment of trachoma

Dr. Warren A. Wilson (Senior Resident Los Angeles County General Hospital; by invitation) stated that 18 patients in all were treated and all had had the old treatment to a greater or lesser extent, including copper stick, silver nitrate, and quinine bisulphate. Three of the children had had Knapp rolling and grattage, one had had a canthoplasty, and three of the adults had had tarsectomies. The ages varied from 8 to 74 years. The duration of the trachoma was 2 to 40 years. Condition of the eyes varied from follicles and early pannus to cicatrix and complete pannus.

Dr. Wilson said that the amount of

sulfanilamide used was least in a girl whose weight was 74 lbs., who received 540 grains, and greatest in a man weighing 190 lbs., who received 2,400 grains. The average was 600 grains for children and 1,000 grains for adults. The average length of treatment was five to six weeks. The usual dosage was one-third grain per pound of body weight for three weeks, followed by one-fourth grain per pound of body weight for three weeks. Two patients who were hospitalized because of severity of the condition, including corneal ulceration, each received three-fourths grain per pound body weight initially, this being somewhat reduced each day. The first patient, who had had the disease for 40 years, was discharged in two weeks; his condition has remained quiet without further treatment (total sulfanilamide 600 grains). The other patient received 80 grains during the first 24 hours and his red-blood-cell count dropped nearly two million. This necessitated a blood transfusion, but after a week or so he was again started on 80 grains (patient's weight 120 pounds), and continued on decreasing amounts for six weeks with no further trouble. This was the only serious complication in this series.

Cyanosis seemed fairly common, Dr. Wilson said, but there was no serious drop in red-blood-cell count or hemoglobin in any case, with the exception of the one mentioned. All patients receive a red and white count and hemoglobin test at least twice a week, and, of course, once before treatment is started. A few patients have had blood sulfanilamide determinations; this varies from 3.5 to 4.0 mg. per 100 c.c. of blood. More work is to be done on this subject. The blood sulfanilamide of patients with gonorrheal conjunctivitis averaged about 10.00 mg. per 100 c.c. but these were all hospital cases and were receiving greater doses of the drug. The only local treatment has been some mild irrigation such as Ringer's solution and 2-percent sulfanilamide ointment in two cases. This latter drug is probably helpful but has not been thoroughly tried out as yet.

Dr. Wilson stated that all of the patients received symptomatic relief within a week and the eyes were quiet in two or three weeks, except for follicles, which disappeared more slowly, taking three or four weeks. The pannus was qualitatively less by slitlamp examination; that is, the corneal vessels were less well filled with blood.

Three of the first patients received treatment for two weeks only. One of these, mentioned above, is still quiet three months later (he was started with three-fourths grain per pound of body weight). The other two had slight recurrences in about one month but responded very well to a second series of treatment.

Plastic surgery in the region of the eye

Dr. William S. Kiskadden (by invitation) presented a large series of slides illustrating a great variety of plastic surgery about the eye.

Contact glasses

Dr. Carrol Weeks presented a motion picture illustrating a method of taking impressions for molded contact glasses. He pointed out that in certain cases the eyeball is so asymmetrical that the standard contact glasses will not fit without discomfort, and in these cases a molded glass can be used. In general, he said, molded glasses are more satisfactory from this standpoint. Particular attention must also be paid to the transitional area between the scleral and corneal curves.

Harold F. Whalman,
Editor.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

THE MAY MEETINGS IN SAINT LOUIS

The American Board of Ophthalmology changed its system of examination from entirely oral to part oral and part written. The latter preceded the former by several weeks and was given simultaneously in several cities. This system is an improvement because it eliminates the obviously unfit. This reduces the numbers to be handled at the oral examination and requires fewer examiners, less time, space, and materials. It also is more impersonal, since papers are corrected without a knowledge of the candidate's identity. This has always been too important a factor. If it is known that he comes from the office of "Dr. Blank" the examinee is only humanly certain to be prejudiced favorably or otherwise by this fact. It might be helpful in order to diminish even more this personal factor if the candidate at the oral test were identified by number only. Some few would naturally be known to some of the examiners, but for the most part this would not be true. Written tests do have disadvantages, but another factor in their favor is that each man is asked the same questions, so that it is simpler to make a comparative rating. The written examination this time apparently revealed some rather astonishing general weaknesses, long suspected but not definitely known. There has undoubtedly been a great improvement in the preparedness of the candidates but there has also been a tendency not to require much in certain subjects, accepting as a fact that little will be known.

Another recent innovation has been the examining of those requiring reëxaminations on a day in advance of the others.

This does extend the time somewhat and throws some additional burden on the organization entertaining the Board, but spreads out the labor of the Board, and this is very desirable because at best theirs is no easy task.

With this activity over, Tuesday was free for the Research Society program. Attendance was small through failure of invitations to reach all members of the section. This was especially regrettable because the program was one of the best ever presented before this group. The purely scientific nature of most of the papers, the sympathetic audience, the longer time allowed for presentation seem to justify this organization's existence. If it were necessary to pick one paper for a blue ribbon the choice would probably fall on Burky's most comprehensive presentation on "Periodic ophthalmia in horses." He showed, apparently conclusively, that this disease, which had baffled science for many, many years, is due, in some cases at least, to the same organism as that which causes undulant fever, the microörganism Brucella. The interesting speculation arises that some of these chronic uveitides, that for want of proof to the contrary have been labelled tuberculous on rather slim evidence, may be examples of brucellosis. The research was beautifully performed and excellently presented.

At the luncheon for this Association, Dr. Edward C. Ellett was nominated for the Dana medal for work in prevention of blindness. This is a very happy selection for honoring an outstanding man in our profession who has devoted his life to the conservation of eyesight.

The Section meeting opened on Wednesday afternoon. Fortunate the men whose papers are scheduled for the first session, because they address a full assembly. Pity the poor fellows who must speak late on Friday afternoon, addressing the heroic remnants of a hectic week.

The editor was unable to be present for more than a few of the papers, so selection for comment is biased by that fact. For the clinically minded, Lancaster's demonstration of a simple but accurate method for measuring the muscle balance looked like an answer to the ophthalmologist's prayer. Confronted by the choice between Maddox rod, which is often inaccurate, and prism cover test, which is a nuisance, he has had to select one of two undesirable methods. If Lancaster's system proves as accurate and easy to handle as in the demonstration that he gave, it is safe to prophesy that it will rapidly come into general use.

The editor visited the leprosarium at Carville, Louisiana, this spring and hence was particularly interested in Pendergast's essay on leprosy. His excellent paper was accompanied by an interesting exhibit. He had spent six months in Carville, so had had ample time to collect and prepare his material.

Outstanding in merit was a paper by Frederick A. Davis on "Primary tumors of the optic nerve." He also had a splendid exhibit.

The House of Delegates deliberated even longer and more earnestly than usual. Product of this was a complete and unanimous rejection of the Wagner Bill, a matter of great importance to every physician. Harry Gradle was elected Chairman for the coming year and New York was chosen for the meeting place—an opportunity for a late view of the Fair.

Lawrence T. Post.

LOW-PRICED OPHTHALMOLOGY IN GREAT BRITAIN

Virtually all human beings at one time or another need medical care, and the physician has been for centuries one of

the chief agents in the distribution of "charity." Because many of his patients were unable to pay for his services, he found it necessary to collect from more prosperous patrons fees sufficiently large to compensate him for the time devoted to the poor. Even today, in certain parts of the world, the same relationship is exemplified by the fact that one entrance to the physician's premises is labeled "Dispensary," and another entrance "Surgery"; the former being the place where fees are minimum (for services to the poor or relatively poor), the latter the place where fees are higher (for services to the well-to-do).

Inasmuch as every effort to establish Utopia seems doomed to disaster, human society is likely to present always widely varying degrees of success and failure, of wealth and poverty; and practical efforts at social reform are aimed rather at mitigation of these differences than at their complete abolition. Increasing recognition of the universal necessity for efficient medical care renders more and more evident the desirability of making adequate provision for every stratum of society, from the richest to the poorest. Today the opinion is very commonly expressed that the rich and the poor are well cared for, and that the most urgent need for improvement in medical service relates to the lower middle class, who pay for what they get and therefore do not come within the purposes of so-called "charitable" institutions, but on the other hand cannot afford the more expensive modern methods of medical investigation, and are not infrequently overwhelmed by the cost of long-drawn-out periods of illness.

The various schemes of community health insurance have been designed especially for the lower-middle-class group. The British national health insurance plan has taken fairly good care of that section of the community in regard to general ailments, notwithstanding certain weaknesses and abuses which have been much publicized in the United States. At first, however, the British scheme made little or no provision for obtaining the services of specialists.

An attempt by the sight-testing opticians of Great Britain to obtain legal recognition, including the establishment of a national licensing system, led in 1927 to the appointment of a government Departmental Committee of investigation. This committee's report pointed out that the work of ophthalmic surgeons was practically limited to the well-to-do and the poor (the latter dealt with in hospital clinics), whereas no such provision was made for the artisan public class.

The apparently imminent danger that the "Optical Practitioners Bill" (the title of the proposed legislation) would be enacted into law paved the way for a promise by the British Medical Association to establish a scheme whereby those of limited income might obtain proper ophthalmologic advice, and also the necessary spectacles, at reduced prices. The result was the creation of the "National Ophthalmic Treatment Board."

The report of the Departmental Committee on the Optical Practitioners Bill contained the following significant statements: ". . . it is possible and probable that the medical profession will be able to provide insured persons . . . with the services of oculists. . . . We hope also that such a service will be extended to the non-insured population.* If, however, for any reason, these hopes are not fulfilled within a reasonable time we do not wish our report to preclude the possibility of a reconsideration of the question in the light of the circumstances then existing."

* That is, of restricted means but not then included within the provision of the national health insurance laws.

The constitution of the National Ophthalmic Treatment Board was drawn up jointly by the British Medical Association and the (British) Association of Dispensing Opticians, and received the approval of the majority of the British ophthalmologists. It has been in operation since 1929. The Board is made up of three medical members appointed by the British Medical Association, three dispensing opticians appointed by the Association of Dispensing Opticians, a medical secretary who is the secretary of the British Medical Association for the time being, and a general secretary who is the secretary of the Association of Dispensing Opticians for the time being. Medical appointments are made upon nomination by the British Medical Association, and dispensing appointments upon nomination by the opticians' organization. The chairman of the Board is a physician and has a casting vote.

As to fees, the arrangement at first established by the British Medical Association was to set up a list of "ophthalmic practitioners" who were "willing to treat insured persons and to prescribe glasses, at a fee of one guinea" (about $5.00 at the present rate of exchange). For various reasons this plan did not work very well, and a later plan provided that the work should be carried on partly in central clinics and partly at "home clinics at the ophthalmic practitioner's consulting room." The fees allowed under the latter arrangement were about $2.50 for consultation and report, with various additional allowances for glasses if these were ordered. Somewhat similar provisions for care of "insured persons" were made by various hospital organizations.

Quite naturally, the work of the National Ophthalmic Treatment Board has been viewed with criticism and sometimes with misunderstanding. It has been accused of being run by a section of the optical dispensing trade, of favoring large dispensing optical firms to the disadvantage of smaller firms, of yielding a substantial income to the British Medical Association, and of affording an excessive profit to the dispensing opticians.

A denial of these criticisms, and an appraisal of the very real benefits which have accrued from the work of the Board, were set forth by the chairman of the Board, N. Bishop Harman, in a recent issue of the British Medical Journal (1939, February 25, Supplement).

When the Board began its work there were in the whole of Great Britain only forty-five establishments conducted by purely dispensing opticians. It had been expected that many of the sight-testing opticians would abandon sight testing and join the ranks of the dispensing opticians, but this anticipation was not fulfilled. Thus, in order to avoid such destructive competition as would have defeated the purposes of the Board, the employer members of the Association of Dispensing Opticians found it advisable to enter into a voluntary agreement that only one dispensing license would normally be granted in respect of each town hitherto without a dispensing service, until such time as a dispensing service had been established in every town in which there was a practicing ophthalmologist.

The most remarkable result of this voluntary agreement is that within less than ten years dispensing establishments have increased tenfold, and the ultimate object of providing a dispensing service wherever there is a practicing ophthalmologist has almost been attained. Employees of dispensing firms have been encouraged to start in business for themselves and to obtain dispensing licenses.

Interesting details of the finances of the National Ophthalmic Treatment Board, as recorded by Harman, are (1) that for initiation of the work of the

Board a substantial loan, since repaid, was obtained from the British Medical Association; (2) that commissions collected by the Board from the dispensing opticians on the sale of spectacles provided under the National Eye Service (amounting to about $225,000) have been in large part devoted to propaganda as to the work of the Board, among the industrial class for which the eye care is intended; (3) that in the past nine years the dispensing opticians have spent not less than $750,000 upon expansion of the dispensing service; that fixed scales of prices for optical appliances have been established by the Board and other organizations concerned; and that expert care under the National Eye Service is furnished only to insured persons and their dependents whose family incomes are not more than $1,250 per annum.

In the United States the British scheme would be approved by some, bitterly condemned by others, partly according to the conditions prevalent in different communities, and partly according to the social and economic beliefs of individual physicians. The efficiency of such low-priced ophthalmologic practice may be open to question: it must naturally vary in the hands of different practitioners. But so, quite often, does the efficiency of clinic practice (where usually no fees to the physician are forthcoming), or even the efficiency of practice (especially refractive practice) among the well-to-do.

Harman concludes his essay by pointing out that the work of the National Ophthalmic Treatment Board has a far wider sphere of advantage than the direct provision which it makes for a restricted social group. The broader gain consists in impressing upon all classes of the community the importance and economic value of medical care of their eyes.

W. H. Crisp.

VITAL STAINING OF THE RETINA

The staining of living tissues was tried as a laboratory experiment 25 years ago. But in general it was found that substances that were effective in such staining were toxic. It remained doubtful if such staining might occur only after the tissue had been devitalized. Recently Arnold Sorsby, of London, found that a certain stain, Kiton Fast Green V, could be used to stain tissue without any dangerous poisoning effects. The clinical dose that would do this was worked out on monkeys. Then the experiment was made on patients with retinal disease. It was found that inflammatory exudates and damaged retinal tissue could be stained without staining the normal retina; although the normal retina could be stained temporarily. He exhibited patients in whom the retina had thus been stained at meetings of the Physiological Society and the Ophthalmological Society, in 1938.

In the January issue of the British Journal of Ophthalmology is a colored plate illustrating the staining of the retina in a case of detached retina, bringing out places at which there were ruptures of the retina and also a slight staining of the atrophic optic nerve. This method seems to offer a means for a diagnosis of retinal disease. Normal retina quickly becomes decolorized. But parts of the retina damaged by a cautery retained the color and thus become evident on ophthalmoscopic examination. Somewhat the same service is rendered as a test of the health of the optic nerve.

This method of clinical investigation might well be applied to the study of glaucoma. It is widely recognized that certain factors in the causation of glaucoma are still not understood. Experimental tests in the early stages might have practical value. It should also be tried in the

early stages of Leber's disease, which has usually been considered an optic atrophy, but which may begin in disease of the macular part of the retina, the nerve atrophy being secondary to the retinal disease. Another practical application of it, which may be of great importance, will be to test for damage to the choroid and retina by methods of cataract extraction that have been found to cause detachment of the choroid, and certainly may cause some damage to the retina.

Edward Jackson.

THE ALLEN PRISM CHART

Two forces capable of producing motion, acting upon the same point from different directions, produce a resultant effect in a direction lying between the directions of the two forces; and an increased effect, dependent upon the angle between their two directions. Conversely a single force acting in the direction of the resultant and equal to it, will produce the same motion as the two supposed original forces. The problem of the parallelogram of forces may be found stated and illustrated, in almost any elementary book on physics. This general relation holds when the forces in question are the refractive effects of two prisms. The resultant prism of a certain strength, acting in the resultant direction, produces the same effect as the two component prisms. One can take pencil and paper and, with a ruler and protractor of angles, can lay out the action and effect of any two prisms acting in any two directions. The working out of a few supposed problems of this kind will bring an understanding of the principle involved. With such an understanding, the revised prism chart of Dr. Thomas D. Allen furnishes a means of reading at a glance the prism strength and direction of its axis, that will be required to compensate any case of heterophoria that has been determined for both vertical and horizontal directions—a hyperphoria with exophoria or esophoria.

Whether one uses a Maddox rod or a phorometer, it is worth while to record the phorias for every refraction case. If it seems important to compensate the phoria in prescribing a correcting glass, a glance at the Allen chart will indicate the direction and the strength of the prism required to do it. To apply the principle, by one's own diagrams for a few cases, may enable one to utilize this time-saving device.

Edward Jackson.

BOOK NOTICES

CORTEZA VISUAL (Visual cortex). By Drs. Flaminio Vidal and Baudilio Courtis. 307 pages, 301 photographs. Buenos Aires, Aniceto Lopez, 1938. Price not stated.

In the introduction the authors state that they have spent many years in gathering, preparing, and examining the material for the work, and this is borne out by the amount of data presented. Their purpose in undertaking this study was to gain a better understanding of the recognition function of the peristriate zone of the visual cortex, with special reference to the localizing value of the symptoms produced by lesions in that area. This monograph is but the first part of a projected series and is intended as a basis for further studies. The first section of the paper is devoted to a description of the macroscopic configuration of the fissures and lobes of the occipital cortex in man, as illustrated by several cases of major psychoses and one case of arteriosclerosis. This is followed by similar descriptions of a large number of specimens from various orders of mam-

mals—primates, elephants, horses, carnivora, rodents, ungulates, anteaters, tapirs, marsupials, and bats. There are also specimens from birds, reptiles, fish, and invertebrates.

The authors conclude that in man there is an unequal development of the two visual lobes, with a parallelism between the development of the visual lobe and the recognition function. It is in birds that the mesencephalic optic lobule acquires its maximum development. The possibility of a zoölogical classification on the basis of cerebral morphology is suggested.

There is a short bibliography.

Frederick A. Wies.

OPHTHALMIC NURSING. By D. E. Grand. Clothbound, 110 pages, illustrated. Baltimore, Wm. Wood and Co., 1938. Price $1.75.

The great responsibility of the nurse in the supervision and treatment of eye diseases is emphasized. The material is presented in outline form and alphabetically arranged so that it may be used as a ready reference book on ophthalmic wards. The section on ophthalmic instruments and operations is well illustrated. The writer displays a keen understanding of the psychology and care of the visually handicapped. William M. James.

OBITUARY

ROBERT SATTLER
1855-1939

Doctor Robert Sattler was born in Cincinnati, Ohio, on July 23, 1855. He was the son of Dr. George and Johanna Langenheim Sattler. His father was a native of Hanover, Germany, and had obtained his degree from the University of Göttingen, coming to Cincinnati shortly thereafter. His mother was a Viennese.

Doctor Robert Sattler was educated in the public schools in Cincinnati, received his medical education at the old Miami Medical College in 1875, and served his internship in the Cincinnati General Hospital, where he became acquainted with Dr. Elkanah Williams, who was the first ophthalmologist west of the Alleghenies, and introduced the ophthalmoscope for the first time to this country in 1855. Dr. Williams induced Dr. Sattler to take up the specialty of ophthalmology. Following this advice he spent one year in New York

Robert Sattler, M.D.

with Dr. Herman Knapp and Dr. Heitzmann. Having completed his course of studies there he went abroad and worked under Von Arlt and Jaeger in Vienna and under Von Graefe in Berlin. He then traveled to Utrecht and worked in Donders's laboratory for some time. Dr. Sattler was well acquainted with Bowman and Hutchinson in London. Returning to

Cincinnati in 1878 he became associated with Dr. E. Williams and Dr. Stephen C. Ayres in a partnership, until the death of Dr. Williams in 1888.

In 1890 Doctor Sattler founded the Cincinnati Ophthalmic Hospital. This hospital was modeled from the European private clinics, taking all cases, rich and poor, coming to the door. There was an enormous clientele to whom Dr. Sattler gave freely of his time and skill. Among those associated with Dr. Sattler at the Ophthalmic Hospital were Dr. Stephen C. Ayres, Dr. Christian Holmes, Dr. Robert Heflebower, Dr. Victor Ray, Dr. A. E. Sanders, and Dr. Clarence King. Among the ophthalmologists living in Cincinnati who were trained by him are Dr. Horace Reid, Dr. Charles Hofling, and Dr. Louis Hendricks. Dr. Sattler was made Professor of Ophthalmology at the Miami Medical College in 1882. In 1910 the Ohio Medical School and Miami Medical College became amalgamated to form the College of Medicine of the University of Cincinnati. Dr. Sattler held the position of Professor of Ophthalmology until 1925.

He was a member of the Cincinnati Academy of Medicine, Ohio State Medical Association, American Medical Association, and of the American Ophthalmological Society, of which he was president in 1914-1915.

His health remained excellent and he was in full vigor until 1925, at which time he underwent several serious operations but recovered sufficient health to continue practice until the day of his death. He died in his office on February 20, 1939, just after he had completed the examination of a patient.

He married Maude Ray, sister of Dr. Victor Ray. She died in 1897. They had six children, four of whom still live. In 1903 he married Agnes Mitchell, who, with their two children survive.

Dr. Sattler was energetic, accurate, resourceful, and a skillful surgeon. He commanded the confidence of his patients and colleagues. The poor received the same consideration as those who were more fortunate.

He was fond of literature and art. He could read and speak fluently Italian, French, and German.

In his death American ophthalmology has lost one of the last few links with the great school of Von Graefe.

He was directly in line with Dr. Williams and in touch with the early discoveries of ophthalmology which revolutionized the subject. His clinic and hospital were kept intact until a few months before his death. To the young ophthalmologists in times of depression and worry he stood like a rock, his steadfastness giving them confidence in the future.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

1

GENERAL METHODS OF DIAGNOSIS

Bahr, Gunnar. **Color photography of the fundus.** Acta Ophth., 1938, v. 16, pt. 4, p. 483.

Like Bedell, the author uses Kodachrome type-A film in a Zeiss-Nordenson camera. Ray K. Daily.

Baltin, M. M. **The application of X rays and radium in ophthalmology.** Viestnik Opht., 1938, v. 13, pt. 5, p. 592.

In Czarist Russia no X-ray service was available. During the Soviet regime two factories for the manufacture of X-ray equipment have been established, and X-ray laboratories have been set up all over the land. Baltin thinks that the ophthalmologic service is not making sufficient use of the available X-ray facilities, and urges closer coöperation between the ophthalmologic and X-ray services.

Ray K. Daily.

Batenko, P. M., and Belostozki, E. M. **The effect of altitude on the blind spot.** Viestnik Opht., 1938, v. 13, pt. 6, p. 816.

The test shows enlargement of the blind spot in high altitudes. Inhalations of oxygen are followed by return of the blind spot to its normal size, which shows that the etiologic factor is anoxemia. Ray K. Daily.

Berens, C., and Beach, S. J. **A chart for testing visual acuity and astigmatism.** Amer. Jour. Ophth., 1939, v. 22, March, pp. 304-305.

Chernikova, T. V., and Rubanovich, I. M. **Roentgenography of enucleated eyes.** Viestnik Opht., 1938, v. 13, pt. 5, p. 629.

The examination proposed by the authors demonstrates ossification of the eye, exudates and hemorrhages in the anterior chamber and vitreous, dislocation of the lens, topography of intraocular foreign bodies, and retinal detachment. With this procedure one can differentiate an actual retinal detachment from an artefact occurring in fixation of the eyeball.

Ray K. Daily.

Escher-Desrivières. **Observation of a moving stimulus in the periphery of the visual field. Quantitative determination.** Bull. Soc. d'Opht. de Paris, 1937, Oct., pp. 587-591.

Two hundred observations are averaged at the four principal meridians, giving results in "centimeter seconds." By closing a switch the subject controls the recording. Thus the reaction time is also recorded. Simultaneous recording of reaction time and extent of field is suggested to be of value in determining ocular fitness for certain occupations. Harmon Brunner.

Ferree, C. E., and Rand, G. **A glareless illuminated holder for visual-acuity test charts with variable intensity of light.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 399-405.

Heinsius, Ernst. **Some aids for testing dark adaptation.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 196.

An examining room for light adaptation, a fixation point for the adaptometer of Engelking-Hartung, the procedure of adaptation tests on series of applicants, and the testing of distinction ability are described in detail. The methods proved very satisfactory in the Marine Hospital at Kiel-Wik.
C. Zimmermann.

Hosford, G. N. **Counterbalanced wall bracket for suspending Comberg slit-lamp.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 427-428.

Martin, H. G. **The practical measurement of accommodation and convergence.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 406-412.

Pickard, Ransom. **A light-threshold apparatus.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 448.

The apparatus differs from that previously described by the author (see Amer. Jour. Ophth., 1937, v. 20, p. 859) in having Wratten light-filters arranged on rotating discs. Beulah Cushman.

Sorsby, Arnold. **Two patients with vital staining of the fundi.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 275.

Basic dyes with a sulphonate radicle, such as kiton fast green, gave staining of the central nervous system and were nontoxic. The normal retina did not stain but damaged retina did stain. This was demonstrated in a patient with chorioretinitis and one with a hole in the retina. Beulah Cushman.

Szász, Alexander. **The dissolving power of the eye and its testing.** Magyar Orv. Arch. (Hungarian), 1938, v. 39, p. 643.

To test the dissolving power of the eye the author constructed three charts upon which squares and oblong figures of exact dimensions were photographed. The size of the figures varied from 120″ to 30″; each consecutive figure was smaller by 10″. The examination was carried out at one and five meter distances. On one chart the distance between the squares equalled the size of the square. On the second chart the distance between two squares was equal to the diameter of two squares. Upon the third chart the distance between the figures was again equal to the size of one square, but the figures were rectangles with bases twice as long as their height. The author is carrying on comparative examinations on a large scale to determine the usefulness of this method. R. Grunfeld.

Vanzant, T. J. **Night blindness as determined by the biophotometer.** Texas State Jour. Med., 1938, v. 34, July, p. 231.

The author describes the use of the biophotometer in testing for night blindness, with particular reference to that type due to vitamin-A deficiency. In tests on 176 patients, using standard values advocated by Jeans and Zentmire, he found 20 percent to be subnormal, 31.2 percent borderline, and 48.8 percent normal. (Illustrations.)

George A. Filmer.

Vishnevskii, H. A. **Charting of the blind spot as a diagnostic and prognostic procedure in ocular diseases.** Viestnik Opht., 1938, v. 13, pt. 6, p. 799.

The author registers recognition of the test object rather than its disappearance from the visual field, and believes that data thus obtained are more accurate. The study failed to show any interrelation between the size of the blind spot and visual acuity. There was also no correspondence between the size of the blind spot and intraocular tension. With marked postoperative fall in intraocular tension the blind spot might be found enlarged. Lowered visual acuity and contraction of the visual field did not always lead to an enlarged blind spot. In retrobulbar neuritis the blind spot was smaller than in other diseases of the optic nerve and could be charted even in the presence of very low visual acuity. In glaucoma the diagnostic feature is not so much enlargement of the blind spot as extension from its upper and lower borders. In persons with unstable fixation the blind spot appears very small and may not be detectable. With corrective glasses, in cases with considerable reduction in visual acuity, the blind spot is smaller than it is without correction. In myopia with myopic conus and posterior staphyloma the blind spot is enlarged. In Seidel's test the change in the blind spot is insignificant. In difficult diagnosis of lesions of the neurovisual apparatus the comparison of the blind spots of the two eyes offers valuable information.

Ray K. Daily.

2

THERAPEUTICS AND OPERATIONS

Attiah, M. A. H., and El Tobgy, A. F. **A preliminary note on the therapeutic effect of short waves in certain eye diseases.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 190.

The biologic actions which are stimulated in tissues exposed to short-wave therapy are listed and two cases are reported. The first was a tumor mass of granular tissue, which showed no improvement after twenty treatments. The second was a case of tuberculous iritis of the nodular type which showed slight improvement after two courses of treatment.

Edna M. Reynolds.

Baltin, M. M. **The application of X rays and radium in ophthalmology.** Viestnik Opht., 1938, v. 13, pt. 5, p. 592. (See Section 1, General methods of diagnosis.)

Berens, Conrad. **Sclerotomy scissors for enlarging corneal incisions.** Amer. Jour. Ophth., 1939, v. 22, March, p. 304.

Birch-Hirschfeld, A. **Short-wave therapy in ophthalmology.** Klin. M. f. Augenh., 1937, v. 103, Jan., p. 107.

The literature contains about 1,500 cases of eye diseases treated with short waves, with favorable results and without deleterious effects. The author treated 94 cases, 57 yielding very good, 24 good, 9 moderate, and 4 no results. The best results were obtained in inflammatory and purulent diseases of the lids and lacrimal sac, superficial keratitis, and neuralgias of the fifth nerve. Ten cases of superficial keratitis and two of corneal ulcer were also irradiated with ultraviolet light, and the

combined treatment yielded better results than one method alone. Two cases of spontaneous and nine of tuberculous iritis reacted rapidly and favorably and so did four of neuroparalytic keratitis, one after longer duration. Short-wave therapy proved beneficial in fifteen cases of exudative choroiditis and out of nine cases of opacity of the vitreous three cleared up quickly and three were improved. Short waves act favorably and soothingly on the anterior segment, and may be beneficial in inflammations of the retina, choroid, and optic nerve. C. Zimmermann.

Brŏns, J. **Local treatment of the eye with vitamin A.** Oft. Selskab i Köbenhavn's Forhandlinger, 1937-1938, pp. 18-22. In Hospitalstidende, 1938, Dec. 13.

Emmetropic school children with symptoms of asthenopia were found to improve with administration of cod-liver oil. The inference was that they suffered from an avitaminosis. Later the author used two concentrated vitamin-A preparations by instillation in the eyes in cases of intractable blepharoconjunctivitis, with very good results.

Indefinite symptoms of pain in the eyes, tenderness of the eyeballs, especially in myopes, for which no explanation could be found, have responded very well to the same treatment. Since instillation of these preparations is often followed by pain, it is always carried out by the physician at his office, once or twice a week.

D. L. Tilderquist.

Busacca, Archimede. **Results obtained by use of sulphanilamide preparations in some conjunctival disturbances and in other ocular affections.** Folia Clin. et Biol., 1938, no. 6, pp. 198-202.

The results in many conditions were negative, but intravenous injection of the drug (para-aminophenylsulphamide) was decidedly beneficial in cases of dacryocystitis and peridacryocystitis. In one case, after a fifth injection of 10 cg. a diarrheal reaction disappeared promptly upon omission of the drug; and a dosage of 5 cg. was resumed after three days, without further complications. W. H. Crisp.

Comberg, W. **Iris adhesions during operations, and a small instrument for reposition of the iris.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 44.

Comberg discusses the iris adhesions occurring during operations, namely folding and adhesion during iridectomy, peripheral folding in cataract extraction, and adhesion by touching the upper lip of the wound in different operations on the eyeball; as well as the difficulty of overcoming them and the deleterious consequences. He has designed a ball-pointed hook for separating adhesions. C. Zimmermann.

Dolfuss, M. A., Di Matteo, and Proux. **Trial of chemotherapy on ocular complications of gonococci by the organic derivatives of sulphur.** Bull. Soc. d'Opht. de Paris, 1938, no. 2, Feb., p. 73.

Results from use of sulphanilamide (1162 F) on dacryoadenitis, gonorrheal conjunctivitis, and ophthalmia neonatorum were favorable as to clinical improvement; but the organisms persisted in some cases. Corneal complications were not improved.

Harmon Brunner.

Frank-Kamenetski, Z. G. **Iridectomy ab externo.** Viestnik Opht., 1938, v. 13, pt. 5, p. 649.

The merit of this technique, according to the author, is avoidance of direct

injury to the lens by the knife and slower emptying of the anterior chamber; which makes spontaneous rupture of the lens capsule less likely.

Ray K. Daily.

Goldfeder, A. E., and Madievskaja, E. I. **The use of novocaine blockade after Speransky-Vishnevsky in ocular diseases.** Viestnik Opht., 1938, v. 13, pt. 6, p. 740.

The experience with fifty cases leads the author to conclude that a paranephric novocaine injection has a favorable effect on ocular diseases. The best results are obtained in acute inflammatory conditions of the cornea and uvea; no undesirable symptoms were noticed; there was usually a focal reaction in the eye and sometimes a constitutional reaction; in similar cases the effect of the procedure was not always the same.

Ray K. Daily.

Grelault. **Hexamethylene-tetramine in ocular therapeutics.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 631-641.

The author states results obtained with this substance in the treatment of various conditions of the eye. He describes in detail the method of injection at the posterior pole of the eye for conditions of the retina and choroid in that region. Another method of administration is injection under the conjunctiva at the limbus. Clarence W. Rainey.

Hasler, W. T., Jr. **Standardization of the preparation of eye drops.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 423-426.

Heupke, W. **Modern questions of nutrition.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 161.

In this lecture the author discusses the importance of diet not only in treatment of internal diseases but also as a supportive in operations and local procedures in ophthalmologic diseases.

C. Zimmermann.

Hughes, C. A. **Poisoning from use of one-percent atropine ointment.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 444.

A 9½-year-old girl became ill the second day the ointment was used, with a temperature of 103°, dry skin, flushed face, scanty urine, and disorientation. The patient was treated for a week with morphine and pilocarpine before her general condition returned to normal. Beulah Cushman.

Kaganova, O. A., and Bikhovski, M. A. **Roentgenotherapy in ocular inflammations.** Viestnik Opht., 1938, v. 13, pt. 5, p. 661.

The experience with 185 cases shows that roentgenotherapy is definitely indicated in episcleritis and fresh cases of scleritis and uveitis. In follicular trachoma this form of therapy is an adjuvant to the usual therapeutic agents. It is less effective in keratitis, dacryocystitis, keratitis rosacea, and epiphora. In blepharitis it produces temporary improvement. Ray K. Daily.

Kolenko, A. B. **Experimental data on desensitization in ophthalmology.** Viestnik Opht., 1938, v. 13, pt. 6, p. 778.

Rabbits, sensitized to horse serum, were given a series of milk injections in increasing doses, with the objective of determining the effect of such injections on the degree of sensitivity. The conclusions are that milk in small and increasing doses serves as a good desensitizer; that preliminary injections do not prevent development of sensitization, and that simultaneous injections of horse serum and milk result in a lower degree of induced sensitivity than is obtained without the milk. Preg-

nant animals are sensitized more readily than normal animals, and the dosage for pregnant animals is not the same as for normal animals. Ray K. Daily.

Lyle, T. K. **Ophthalmic operations under evipan anesthesia.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 299.

The technique of using evipan is given in detail, with indications as well as contraindications. Lyle feels that it is especially indicated in squint operations, excision and evisceration of the eyeball, operations for acute glaucoma, iris prolapse, excision of the lacrimal sac, and lid and cataract operations.

Beulah Cushman.

Orlova, E. V. **Carotin in the treatment of diseases of the anterior ocular segment.** Viestnik Opht., 1938, v. 13, pt. 4, p. 560.

On the basis of clinical experience the author concludes that carotin stimulates tissue recovery. He found it especially effective in burns and in trophic ocular disturbances. It possesses analgesic but no anesthetic properties. It shortens the course of the disease but does not prevent recurrence.

Ray K. Daily.

Remelé. **The value of the gold preparation Solganal B oleosum in the treatment of ocular tuberculosis.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 88.

The author reports on his treatment of 23 cases (35 eyes) of ocular tuberculosis (iridocyclitis, sclerokeratitis, choroiditis, papillitis, and retrobulbar neuritis). Over a period of six years he obtained complete cure in 25 eyes, some improvement in 3, and considerable benefit in 7. C. Zimmermann.

Riad, Mahmoud. **Idiosyncrasy to pontocaine.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 188.

A case of marked idiosyncrasy to pontocaine in a young man suffering from spring catarrh.

Edna M. Reynolds.

Rowbotham, E. S. **Paraldehyde narcosis.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 306.

Paraldehyde is one of the safest narcotic drugs. It is given by rectum, and the narcosis can be prolonged after the operation as long as necessary. Local anesthetics must be relied upon to protect the patient from pain. The detailed method is given, as applied to different groups of patients.

Beulah Cushman.

Sander-Larsen, S. **Pontocaine eczema.** Acta Ophth., 1938, v. 16, pt. 4, p. 647.

The author reports several cases of eczema of the hands caused by pontocaine, and warns against its use in surgery of the eye, for fear of encountering patients sensitive to the drug.

Ray K. Daily.

Weekers, L. **Treatment of ocular affections with orbital injections of alcohol.** Ann. d'Ocul., 1939, v. 176, Feb., pp. 81-99.

Injection of alcohol into the orbit is not so dangerous as is commonly believed. As much as 1 c.c. of 40-percent alcohol may be injected without fear of damage to the optic nerve, although moderate discomfort may ensue for a short period. Alcohol injections are very satisfactory in control of ocular pain from various causes. Both clinical experience and animal experiments indicate that alcohol produces a definite fall in intraocular pressure which may last for several days. It also helps to control photophobia, lacrimation, and blepharospasm. The only serious complications which the author has en-

countered are transient paralysis of the external rectus and permanent paralysis of the pupil. John M. McLean.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Ajo, A., and Teräskeli, H. **Additional flicker studies in color blindness.** Acta Ophth., 1939, v. 16, pt. 4, p. 518.

The authors add one more color-blind case, studied with the flicker method, to the two whose findings they reported in a previous publication (see Amer. Jour. Ophth., 1938, v. 21, p. 693). The tabulated report on the third, totally color-blind patient, shows that the fusion frequency was one third of its normal value, that it was independent of the illuminated area, and that it was constant for the entire visual field. The fusion frequency during dark adaptation is lower than in normal eyes, and is represented by a single curve; the fall in fusion frequency during dark adaptation sets in later than normal. Uniform fusion frequency in the entire visual field indicates to the authors a lack of differentiation between the receptors of the center and periphery of the retina. Delayed fall in fusion frequency during dark adaptation suggests a disturbance in the function of the rods. Ray K. Daily.

Baratta, Orazio. **Experimental researches on the action of sympamine.** Boll. d'Ocul., 1939, v. 17, May, pp. 401-413.

Note: Sympamine, or phenyl-isopropyl-amine, is known as benzedrine in the United States.

In tabulated form the writer gives the results of his experiments with this substance on normal human eyes. Upon instillation it provokes mydriasis for about one hour by stimulation of sympathetic terminations. If used together with cocaine it gives signs of unilateral synergism; with homatropine and atropine it increases their mydriatic effect. Pilocarpine has a prompt contracting action on a pupil dilated by sympamine, whereas, if pilocarpine has been instilled first sympamine has no effect on the miosis. Sympamine does not affect intraocular tension. Thus the drug may be used in ophthalmology for diagnostic purposes. (Bibliography.)

Melchiore Lombardo.

Barbel, I. E. **Congenital achromatopsia.** Viestnik Opht., 1938, v. 13, pt. 5, p. 598.

A report of a thorough study of three cases. In two, dark adaptation was more active than normal, a phenomenon which the author explains by absence of the inhibitory action of the cone apparatus. In the third case, which had bilateral macular coloboma, dark adaptation was normal. A central scotoma could not be demonstrated, and the history was that the nystagmus and photophobia had improved with the age of the patient. These phenomena lead the author to assume that the case represents an atypical adaptability of the rod apparatus. Ray K. Daily.

Berens, C., and Beach, S. J. **A chart for testing visual acuity and astigmatism.** Amer. Jour. Ophth., 1939, v. 22, March, pp. 304-305.

Bosa, F. **The pH of the aqueous and lens in parathyroidectomy.** Rassegna Ital. d'Ottal., 1938, v. 7, Sept.-Oct., pp. 613-621.

Bosa removed the parathyroids from fifteen rabbits and studied the pH of the aqueous and lens in relation to the production of cataract in such animals. He found that there was a slow but evident increase in the pH of the blood

serum, the aqueous, and the lens. This rise of pH tends to overcome the increased imbibition of fluid by the lens which occurs in parathyroidectomized animals. Eugene M. Blake.

Cogan, D. C., and Cogan, F. C. **Color fatigue in the peripheral visual field.** Ophthalmologica, 1938, v. 96, Dec., p. 137.

The authors measure color fatigue by noting the time it takes for a square of colored paper mounted on a neutral grey of the same luminosity to lose its hue and disappear on the background. This was repeated at spaces on the retina separated by ten degrees, brought about by changing the point of fixation rather than the position of the color object. Red, green, yellow, and blue were used and data were gathered upon four subjects. The variation among normal individuals was too great to permit the use of color fatigue as a clinical test. Fatigue is more easily induced in the periphery. The eyes fatigued most readily for green and least for red. Increase of size of object was associated with a disproportionate increase of fatigue time. With increase of light intensity, there was some increase in fatigue time. Binocular fatigue time was not appreciably longer than monocular. F. Herbert Haessler.

Crisp, W. H. **Shall we use cycloplegics?** Amer. Jour. Ophth., 1939, v. 22, April, pp. 392-395; also Trans. Amer. Ophth. Soc., 1938, v. 36, p. 35.

Crozier, W. J., and Holway, A. H. **Theory and measurement of visual mechanisms. 1. A visual discriminometer. 2. Threshold stimulus intensity and retinal position.** Jour. Gen. Physiology, 1939, v. 22, Jan. 20, pp. 341-364.

A device is described which permits the investigation of different aspects of human visual excitability over a wide range of luminous intensities. Monocular threshold-stimulus intensities were measured along the 180° meridian in three subjects. No direct correlation was found to exist between visual sensitivity and the number of retinal elements. Binocular threshold stimuli were also measured along the same meridian and found to give results essentially similar to those for monocular sensitivity. It is concluded that the results show the process of threshold response to be localized in the central nervous system and not in the retina.

T. E. Sanders.

Doesschate, G. ten, and Fischer, F. P. **Concerning optical illusions produced by a rotating beacon.** Ann. d'Ocul., 1939, v. 176, Feb., pp. 103-109.

The authors discuss the apparent curvature of a lighthouse beam when seen at night, a phenomenon which has been debated for many years in connection with real and apparent distances. They believe that there is a definite limitation of visual space at night to about 100 m., and that projection of points on a straight line to a circle with such radius produces the illusion of bending, starting about 49 m. from the point of observation.

John M. McLean.

Escher-Desrivières, J. **The sensibility of the peripheral retina for moderate brilliance.** Bull. Soc. d'Opht. de Paris, 1938, Jan., p. 7.

A photometric monocular comparison was made between the fovea and the retinal area eight degrees from the central axis. It was found that to secure equal brightness the illumination of the peripheral object had to be reduced as follows: white light, 0.47 to 0.60; yellow, 0.53 to 0.67; blue-green, 0.44 to 0.35. There was no difference for red. Illumination was never below one lux.

The usually accepted figures are for reduced illumination.

Harmon Brunner.

Haas, Emil. **Contact glasses.** Bull. Soc. d'Opht. de Paris, 1937, Nov., supplement.

A report of 250 pages to the full society. The subject is covered completely, beginning with the optics, physics, history, types and their manufacture, and application. Of especial interest are methods of fitting: moulage or casts, ophthalmometric measurement, Heimbold's sclerokeratometer (a device of numerous small rods in principle like the apparatus hatters use in fitting the head), and Strebel's rule and tables (which use as a basis a circular contact glass to find the scleral curvature).

The solutions most used are Ringer's and saline. Gifford's solutions are approved. Experiments indicate no need for a bubble in the solution to permit corneal respiration. Many cases of apparent intolerance are relieved by changing solutions. The appearance of halos after wearing a glass only means that the eye should be given a brief rest, and it is often relieved by changing solutions, as it arises from epithelial edema. Few serious consequences from contact glasses are mentioned in the literature.

A canvas of continental authors favored the Müller-Welt blown glasses over the Zeiss ground ones in theory; but the difficulties of fitting are much greater. Orthopedic claims for contact glasses are exaggerated, in the author's opinion. The literature tells of keratoconus cases showing improvement in the central opacity, corneal curvature, and astigmatism, as well as improvement in vision of the naked eye. The author's investigations do not confirm these as permanent changes. No well authenticated lowering of intraocular tension in keratoconus was found. Use of an opaque contact glass with a small pupil over a clear part of the cornea is mentioned. In one case this was combined with optical iridectomy. (182 references.) Harmon Brunner.

Hecht, S., Peskin, J. C., and Patt, M. **Intensity discrimination in the human eye. 2. The relation between Δ I/I and intensity for different parts of the spectrum.** Jour. Gen. Physiology, 1938, v. 22, Sept., p. 7.

The authors describe a new apparatus for measuring visual-intensity discrimination over a large range of intensities, with white light and with selected portions of the spectrum. The procedure and measurements are given. The present numerical data, like most of the previously published data from various sources, are all described with precision by the theory which supposes that intensity discrimination is determined by the initial photochemical and chemical events in the rods and cones. (Table, graphs.) F. M. Crage.

Holm, E., and Lodberg, C. V. **Genealogic study of color blindness.** Acta Ophth., 1939, v. 16, pt. 4, p. 524.

An analysis of nineteen color-blind patients in a family of three hundred individuals, among which is the case examined anatomically by Larsen (see Ophth. Year Book, 1924, v. 20, p. 225). Consanguinity was found in 30 percent of the color-blind. Ray K. Daily.

Jackson, Edward. **Subjective study of visual aberrations.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 384-387; also Trans. Amer. Ophth. Soc., 1938, v. 36, p. 46.

Jaensch, P. A. **Hereditary factors in myopia.** Med. Klinik., 1939, v. 35, Jan. 20, pp. 69-71.

The author reviews the recent literature on the heredity of refractive errors, with special consideration of myopia. Myopia is not congenital, but has a congenital "anlage," and the influence of heredity is established beyond doubt. The mild degrees of myopia under six diopters seem to follow the dominant type of heredity, while the high and progressive types have been found in the majority of cases to be recessive. The degenerative changes in the macula and around the optic nerve, which are frequently associated with high myopia, are not to be interpreted as consequences of this myopia, but are identical with similar changes in the senile eye, and like these are hereditary. There are, however, factors, so far unknown, which influence and modify the picture of myopia in the individual case. These factors have to be sought in the environment and daily life of the individual. While we have no means of arresting progressive myopia, sight-saving classes have done much to minimize the handicap of such children, and it is proposed to place in such classes all offspring of families afflicted with progressive myopia, who have a myopia of over eight diopters.

Bertha A. Klien.

Litinskii, G. A. **The rapidity of depth perception.** Viestnik Opht., 1938, v. 13, pt. 6, p. 850.

A detailed report of an investigation based on the data obtained from one hundred test persons. The conclusions are that rapidity of depth perception runs parallel with acuity of depth perception. Training of pilots develops depth perception and increases its rapidity. Persons with orthophoria have no greater rapidity of depth perception than persons with heterophoria.

Ray K. Daily.

Rohr, Moritz. **On the development of spectacles with special reference to recent improvements.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 359.

Detailed observations regarding the general history of spectacles is given from the year 1600. Later the use of the center of rotation and its importance for the design of spectacle lens is described, and the development of symmetrical lenses of high collective power as made in Jena from 1908. A description of telescopic and contact lenses is given. Beulah Cushman.

Rössler, Fritz. **Ten years experience with the Cobalt lamp, and new observations (spontaneous changes of astigmatism), in subjective tests of refraction.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 176.

Since the author in 1927 reported his first attempts to determine the refraction of the eye by means of color dispersion, an essential improvement in the method has been made with the Cobalt lamp of Zeiss. Rössler now gives details of experiences and observations in a total of over 10,000 examinations. C. Zimmermann.

Tscherning, M. **Concerning human vision.** Oft. Selskab i Köbenhavn's Forhandlinger, 1937-1938, pp. 8-12. In Hospitalstidende, 1938, Dec. 13.

There is a mechanism in the human eye by which the light of a light area in the field of vision tends to project itself, or rather to overflow, into a darker area, so that if fixation is prolonged the whole gives the appearance of a uniformly lighted area. This principle asserts itself in the elimination of the blind spot and the shadows of the retinal vessels from the normal field of vision. This also explains the fact that

the patient is sometimes not aware of blind areas in the field due to pathologic defects in the retina.

D. L. Tilderquist.

Williamson-Noble, F. A. **Contact lenses considered from the clinical standpoint, with a survey of the results obtained.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 2, p. 535.

The author classifies the clinical indications as optical, occupational, and cosmetic. The optical group includes any surface irregularity of the pupillary area of the cornea, such as conical cornea, corneal facets, pemphigus, myopia, aniridia, albinism, and defective central vision.

The occupational indications include occupations in which fogging by steam or rain precludes the wearing of ordinary spectacles. In many recreations also, such as football, baseball, hunting, and shooting, they are of great advantage. Finally, if only used for cosmetic reasons they are very helpful. The results of a questionnaire to patients on the benefits and advantages are given.

Beulah Cushman.

4

OCULAR MOVEMENTS

Adrogué, Esteban. **Disturbances of associated eye movements.** Arch. de Oft. de Buenos Aires, 1938, v. 13, Aug., p. 408.

A summary of our present knowledge concerning the anatomy, physiology, and pathology of the higher centers regulating associated movements of the eyes is given in some detail, together with a discussion of the clinical significance of disturbances of motility which fall in this category.

Edward P. Burch.

Anderson, J. R., and Mann, D. S. **The orthoptic treatment of concomitant convergent strabismus.** Med. Jour. Australia, 1939, v. 1, Jan. 14, pp. 59-65.

A series of 81 cases of concomitant convergent strabismus treated by orthoptics in private practice is reported. Thirty-eight cases had normal retinal association when first seen and 43 had not. Twenty-four patients with normal association were treated by orthoptic training alone, of which 71 percent were cured, receiving an average training of 49 visits in 52 weeks. Ten patients in this group were treated by training and operation, 50 percent of them being cured by an average training of 67 visits in 95 weeks. Of the 43 patients with dissociation, 33 were treated by training alone, and 10 by operation alone. Of the 33 treated, 12 percent were cured and 21 percent almost cured.

T. E. Sanders.

Berens, Conrad. **A new prism bar.** Amer. Jour. Ophth., 1939, v. 22, March, pp. 305-306.

Berens, Conrad. **Tenon's capsule transplantation in surgery of the ocular muscles, with especial reference to postoperative deviations with adhesions between the muscles and the eyeball.** Trans. Amer. Ophth. Soc., 1937, v. 35, p. 173. (See Amer. Jour. Ophth., 1938, v. 21, May, p. 536.)

Bielschowsky, A. **Lectures on motor anomalies. 7. Paralysis: general symptomatology.** Amer. Jour. Ophth., 1939, v. 22, March, pp. 279-288.

Bielschowsky, A. **Lectures on motor anomalies. 8. Paralysis of individual eye muscles: abducens-nerve paralysis.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 357-367.

Cairns, Hugh. **Peripheral ocular palsies from the neurosurgical point of**

view. Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 2, p. 464.

The author discusses his experiences with verified lesions of the oculomotor nerve. For the most part, expanding lesions within the orbit and cranium were found, and the clinical picture depended upon the speed with which the distortion was produced. (3 case reports, illustrations.) Beulah Cushman.

Cass, E. E. **Strabismus: abnormal retinal correspondence.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 276.

The author divides abnormal retinal correspondence into three groups. In the first, of alternators and cases of marked amblyopia, only false correspondence can be elicited. The second group occurs chiefly in squints with moderate amblyopia and an angle over ten degrees. The third group, much smaller, occurs in small-angle squints with either good vision in each eye or an amblyopia which is quickly improved by occlusion. Treatment of the first and second groups was for cosmetic purposes only, if congenital amblyopia was present. The alternators, if operated upon early with training afterward, usually recovered. The third group can get rid of the false correspondence by persistent training.

Beulah Cushman.

Jayle, Mingardon, and Labastie. **New contribution to the study of vestibular reactions in strabismus cases.** Bull. Soc. d'Opht. de Paris, 1937, Oct., pp. 595-607.

Whirling tests were performed on 46 cases, which included each type of strabismus, two cases of spontaneous nystagmus, and two cases of spontaneous combined with latent nystagmus. Each variety of strabismus showed examples of normal reactions. Cases showing clear-cut vestibular syndromes, of paralytic type, occurred in the monocular strabismus group. The origin, probably supranuclear, could condition the strabismus; no direct connection was found. (A preliminary report.)

Harmon Brunner.

Jayle, G. E., and Ourgaud, A. G. **The atypical syndrome of Foville.** Arch. d'Opht. etc., 1939, v. 3, Jan., p. 31.

The syndrome of Foville (paralysis of lateral gaze) consists of a complete or partial paralysis of gaze toward either side or sometimes toward both sides. As recovery progresses, nystagmus occurs, with large oscillations when the gaze is directed toward the affected side. Voluntary motility and automatic reflex motility are generally affected and classically in the same direction. Thus defined, the syndrome has an important localizing value, placing the lesion in the pons at the level of the nucleus of the oculomotor nerve and the posterior longitudinal bundle. There may or may not be an associated facial paralysis. Five cases showing more or less of the classical syndrome are described. Nystagmus played a major rôle in most of the cases, indicating that there was some disturbance of the oculo-labyrinthine pathways. For this reason the authors have called the syndrome presented an atypical Foville syndrome. They believe that it is of particular importance as a diagnostic sign of multiple sclerosis.

Derrick Vail.

Jung, Richard. **An electric method for multiple registration of nystagmus and other ocular movements.** Klin. Woch., 1939, v. 18, Jan. 7, pp. 21-25.

The author describes in detail a convenient electric method for registration

of the horizontal and vertical components of the movements of both eyes simultaneously but independently of each other. The method utilizes the potential differences of corneoretinal potential, which are registered by oscillographs. It permits detailed analysis of normal and pathologic complex ocular movements, and its only disadvantage is the inability to register movements which do not exceed five degrees.

Bertha A. Klien.

Kiehle, F. A., and Henton, G. H. **The results of squint operations: a review of the last 286 cases at the University of Oregon clinic.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 422-423; also Trans. Pacific Coast Otò-Ophth. Soc., 1938, 26th mtg.

Merlin, L. A. **Method of testing muscle balance in ambulatory examinations.** Viestnik Opht., 1938, v. 13, pt. 4, p. 552.

The author uses a stereoscope with appropriate charts. Ray K. Daily.

Miklos, Andor. **Our experience with the Blaskovics squint operation.** Szemészet, 1938, v. 1, Dec., p. 52.

The author reviews the results of 170 squint operations carried out according to the method of Blaskovics. He finds this method superior to all others, because myectomy can be exactly graduated, and because by tightening the sutures during aftertreatment an undercorrection can be improved or by removing the sutures earlier an overcorrection can be minimized. A further advantage of this method is that the operation can be done in one stage and it suffices to operate on one eye even if the angle of squint is very great. After myectomy the two eyes should appear parallel. After tenotomy a convergent squint should be overcorrected four or five degrees, while a divergent squint should never be overcorrected.

R. Grunfeld.

Schlaeppi, V. **Essential congenital hyperfunction of the inferior oblique.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 586-594.

The author describes the diagnostic schema used to define paralyses and contractures of the vertical muscles of the eye, plotting the vertical excursions of the double images in degrees. Disappearance of the head tilting and vertical divergence are to be noted in pictures taken before and after tenotomy.

Clarence W. Rainey.

Stenius, Sten. **Remarks on strabismus and its treatment in children.** Acta Ophth., 1938, v. 16, pt. 4, p. 550.

An analysis of fifty cases of concomitant convergent strabismus observed over a period of three years. Refraction and treatment for amblyopia secured binocular vision only in cases of periodic strabismus. Ray K. Daily.

Szymanski, J. **Subconjunctival rectus-muscle shortening.** Klinika Oczna, 1938, v. 16, pt. 6, p. 756.

A fold of muscles is clamped with forceps and tied with two sutures. The fold is cut off and the conjunctival wound closed. (Illustrations.)

Ray K. Daily.

5

CONJUNCTIVA

Andrade, Lopez de. **Studies on trachoma.** Ann. d'Ocul., 1939, v. 176, Jan., pp. 33-40.

Intraocular rabbit inoculation with fresh trachoma material as described by Szily was repeated with similar result. Of 30 patients studied, 18 had definite

trachoma, and 12 had other conjunctival diseases. The trachomatous patients had marked lymphocytosis but did not show any significant eosinophilia. Trachomatous patients had no definite hypocalcemia and no alteration in alkaline reserve. John M. McLean.

Attiah, M. A. H., and El Tobgy, A. F. **Factors influencing course of trachoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 137.

Variations in individual and racial resistance, acquired immunity, and seasonal exacerbations of trachoma are discussed. The occurrence of exacerbations in trachoma coincides with certain seasonal epidemics of acute ophthalmias and certain seasonal climatic changes. Cases of trachoma which are so mild as to give no symptoms become acute when secondary bacterial infection occurs. Treatment of such bacterial infection transforms the severe type of trachoma into a mild form. Secondary infection of the meibomian glands is a potent source of continuous corneal irritation. Another accessory factor in trachomatous keratitis is allergy to tuberculoprotein.

Edna M. Reynolds.

Bencini, Alberto. **"Essential" shrinking of the conjunctiva.** Boll. d'Ocul., 1938, v. 17, May, pp. 313-336.

A man 69 years of age had shown for fifteen years symptoms of chronic catarrhal conjunctivitis, with photophobia, trichiasis, and corneal ulcers. Both lower lids had become partially adherent to the eyeball. There was keratinization of the bulbar conjunctiva, with corneal vascularization and pterygium-like formations. Another man, aged 48 years, showed a dry, thick, lower palpebral conjunctiva and shallow fornix. The cornea was vascularized and opaque, with symblepharon at the external end of each lid on both eyes. Histologic examination of conjunctiva, skin, and lids showed epithelial changes with a slight inflammatory reaction in the conjunctiva, and with more marked changes in the dermis of the skin and lids due to poorly defined factors. (Bibliography, 3 tables, 12 colored figures.) M. Lombardo.

Blegvad, Olaf. **Pemphigus of the conjunctiva and of the mouth.** Oft. Selskab i Köbenhavn's Forhandlinger, 1937-1938, pp. 1-4. In Hospitalstidende, 1938, Dec. 13.

In a case of chronic pemphigus of the conjunctiva there were acute manifestations of the same disease on the mucous membranes of the mouth and throat. D. L. Tilderquist.

Bower, A. G., and Frank, W. **Treatment of gonorrheal ophthalmia.** Amer. Jour. Ophth., 1939, v. 22, March, pp. 277-278.

Burnier, Penido. **Trachoma and its treatment with sulphanilamide.** Rev. de Oft. de São Paulo, 1938, v. 6, Oct.-Nov.-Dec., pp. 214-220.

The author gives an analysis of thirty cases so treated. The results were generally good, with rapid diminution in photophobia, lacrimation, secretion, and blepharospasm. (Discussion.)

W. H. Crisp.

Cornet, Emmanuel. **True and false papillary conjunctivitis.** Ann. d'Ocul., 1939, v. 176, Feb., pp. 100-102.

From conditions which simulate it, true papillary conjunctivitis may be distinguished by attempting to express the excrescences. There are three types of true papillary conjunctivitis: papillary vernal conjunctivitis, papillary syphilitic conjunctivitis, and papillary

conjunctivitis secondary to chronic irritation of the conjunctiva or lacrimal passages. False papillary conjunctivitis or pseudopapillary conjunctivitis is divided into infiltrating pseudopapillary trachoma and granular pseudopapillary trachoma. In both of these the lesions may be crushed and expressed, proving the differential diagnosis.

John M. McLean.

Dulewiczowa, M. **Surgical therapy of trachoma.** Klinika Oczna, 1938, v. 16, pt. 6, p. 971.

A review of the literature.

Ray K. Daily.

Greene, L. S., and Perry, M. W. **Erythema nodosum with nodules in the conjunctivae.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 389-391.

Hirschfelder, Max. **Treatment of trachoma with sulphanilamide.** Amer. Jour. Ophth., 1939, v. 22, March, pp. 299-300.

Katznelson, A. B., and Pris, I. I. **Phlyctenular ocular diseases and tuberculosis.** Viestnik Opht., 1938, v. 12, pt. 4, p. 447.

On the basis of 270 cases of phlyctenular keratoconjunctivitis, the author comes to the following conclusions. Tuberculous etiology may be considered established on the basis of clinical and roentgenologic findings as well as on tuberculin reactions. The majority of cases of phlyctenular conjunctivitis occur between one and eleven years of age, and females are affected more frequently than males. The majority of the patients have clinical and roentgenologic changes, active in character in two thirds of the cases. In all cases, even in the absence of clinical signs, there is a high sensitivity to tuberculin, although there is no parallelism between the intensity of the disease and that of the tuberculin reaction. The younger the patients, the greater the percentage with clinical symptoms. Among the active forms of tuberculosis the infiltrative type predominates. The presence of cavernous changes makes the prognosis of the ocular infection more grave. Active clinical tuberculosis is most frequently found in cases of avascular keratitis, less frequently in pannus, and in 50 percent of cases of phlyctenular conjunctivitis. Phlyctenules at the limbus, and avascular keratitis, are early manifestations of tuberculosis. Pannus develops after recurrent attacks and is therefore seen in older people. Exacerbations of pannus keratitis are less dependent on the toxicity of the tuberculous focus than are other forms of phlyctenulosis. Phlyctenular keratoconjunctivitis is frequently the only symptom of active tuberculosis and it should lead to early diagnosis of the disease. Ray K. Daily.

Khalil, M. **Treatment of trachoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 151.

A brief outline of the author's method of treatment of all stages of trachoma is given. Edna M. Reynolds.

Koch, F. L. P. **Ocular pemphigus.** Amer. Jour. Ophth., 1939, v. 22, March, pp. 300-304.

Lyons, F. M. **The biomicroscopy of spring catarrh.** Giza Mem. Ophth. Lab., 1937, 12th ann. rept., Appendix no. 2, pp. 1-13.

The author describes in detail the different types of palpebral and bulbar spring catarrh and explains their development. His observations on the bulbar forms provide an explanation of the minute anatomy at the limbus (such as the "secondary groove" and keratitis

epithelialis vernalis). The initial and all-important feature of the disease is an abnormal exudation of fibrin and wandering cells from certain groups of the conjunctival capillaries. Connective-tissue hyperplasia is not a primary feature of the disease. The form each lesion takes depends upon the structural characteristics of the site involved and the degree of capillary leakage. The etiology is still unknown, but the characteristic diagnostic signs of spring catarrh are: bright glistening appearance of the tarsal conjunctiva, fine sticky filaments or membrane which can be removed from the tarsus, itching of the lids, general pallor of the patient, and conjunctival eosinophilia. The latter in itself is not diagnostic unless found in conjunction with the fibrinous discharge. Lawrence G. Dunlap.

Mathis, Giovanni. **Bacteriology of the conjunctiva of myxomatous rabbits.** Rassegna Ital. d'Ottal., 1938, v. 7, Sept.-Oct., pp. 661-665.

Rabbits suffering from myxoma develop an intense conjunctivitis with chemosis, abundant secretion, blepharitis, and so on. The author studied bacteriologically twenty rabbits which had been injected with myxomatous virus. The organisms found were staphylococcus aureus and albus, micrococcus tetragenus, and streptococcus. He concludes that the bacteria are in no way specific. Eugene M. Blake.

Medunina, I. I. **Keratoconjunctivitis in hypofunction of the lacrimal glands.** Viestnik Opht., 1938, v. 13, pt. 5, p. 655.

A review of the literature and a report of a case of conjunctivitis sicca with diminished lacrimal secretion. All forms of therapy recommended for this affliction were ineffective in this case. Ray K. Daily.

Meyerhof, Max. **Remarks on trachoma healing without visible scar formation.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 145.

Many cases of trachoma which healed without treatment and with very superficial conjunctival scarring are cited. Healing with very slight scarring can be obtained by daily superficial scraping of the conjunctiva followed by gentle rubbing with 1 to 1,000 bichloride of mercury, argyrol, or a hypertonic solution of copper sulphate. Edna M. Reynolds.

Paez Allende, Francisco. **Pterygium.** Arch. de Oft. de Buenos Aires, 1938, v. 13, Aug., p. 438.

This is a brief outline of the surgical management of pterygium according to the technique of Duverger, which the author has employed in 71 cases. Edward P. Burch.

Pages, Duguet. **Sulphanilamide in gonococcic blennorrhea.** Bull. Soc. d'Opht. de Paris, 1938, no. 2, Feb., p. 94.

The results were rather uniformly good. In discussion Terrien urges that usual local measures be continued in every case, because of the danger of corneal complications. The dose should be close to the tolerance level of the individual. Harmon Brunner.

Porsaa, K. **Xerosis of the conjunctiva not due to avitaminosis.** Oft. Selskab i Köbenhavn's Forhandlinger, 1937-1938, pp. 32-35. In Hospitalstidende, 1938, Dec. 13.

In opposition to the general theory that xerosis of the conjunctiva is due either to injuries, such as burns, or to a lack of vitamins, two case reports of xerosis in healthy and well nourished adults are given. In both, there was a triangular dry area of the conjunctiva,

temporal to each cornea, which corresponded to what is described under the name of Bitot's plaques. The spots were of long duration, gave no symptoms, were not progressive, and did not stain with any dyes. Dark adaptation was normal. Both patients had been treated for long periods with vitamins, without result. The author's theory is that these spots were due to absence of the normal beaker cells which furnish a great portion of the moisture to the conjunctiva.

D. L. Tilderquist.

Prettin, Heinz. **Uliron, a new remedy for gonorrheal conjunctivitis.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 114.

In a very severe case of gonorrheal conjunctivitis with infiltration of the cornea, at the age of 29 years, the author had excellent results from this drug. C. Zimmermann.

Prigozina, A. L. **Clinical and morphological allergic reactions in the conjunctiva.** Viestnik Opht., 1938, v. 13, pt. 6, p. 766.

A review of the literature and a report of three cases with micropathologic studies. The conclusions are that phlyctenules and fleeting nodules are the manifestations of varying phases of local allergy. In low sensitivity the pathology is that of inflammation and infiltration, and in high sensitivity that of an aseptic necrosis. The pathogenesis of these changes is closely related to tuberculous allergy, but in some cases may be non-specific in character. In such cases, in addition to the conjunctival affection there is always an edema or hyperemia of the mucous membrane of the upper respiratory tract, unilateral if only one eye is diseased. Not infrequently there is a disturbance in the swallowing reflexes. The corneal sensitivity is also reduced, sometimes only in the diseased eye, but more frequently in both eyes. The efflorescences are located superficially in the cornea and in the mucous membranes. Hemograms show slight leucocytosis and sometimes a shift to the left, with absence of eosinophilia. Neurologic examination reveals a vegetative neurosis. In this type of case tuberculin therapy, in small doses, is provocative of anaphylactic symptoms. The pathologic anatomy of the tissue excised for biopsy shows a granulomatous reaction in the form of an epithelioid nodule with a tuberculous structure. (Photomicrographs.)

Ray K. Daily.

Reitsch, W. **Rhythmic and other practical symptoms for the diagnosis of diplococcus infection.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 112.

Exacerbations, pain, and impairment of sight in the evening are said to be characteristic signs of diplococcus conjunctivitis. C. Zimmermann.

Stewart, F. H. **Experimental pathology of trachoma.** Giza Mem. Ophth. Lab., 1937, 12th ann. rept., Appendix no. 1, pp. 1-27.

Stewart deals with microscopy of trachoma, virulence, filtrability of the trachoma virus, attempts to grow the virus on the chorio-allantoic membrane of the hen, purification of the virus, attempted culture of media containing cells, and transmission of trachoma by lice and flies. He states that elementary granules are not infective, although Thygeson and others have been able to induce genuine trachoma in the human with a filtrate containing only elementary bodies. Stewart also states that the infection is carried by the initial body and not by the smaller elementary bodies. In Egyptian trachoma free initial bodies are rarely seen. In

1937 Stewart found free initial bodies in only 7 of 37 cases, but he found the secretion from one lid sufficient to infect anywhere from 20 to 384 animals. Inclusions can be found in 100 percent of early cases of Egyptian trachoma, but elementary granules are not so numerous in Egyptians as in American Indians.

There is considerable evidence that the infectivity of trachoma is either due to or connected in some way with the elementary body, so that conflicting conclusions regarding the filtrability of trachoma virus are probably due to the fact that successful transmission depends largely on virulence and virus concentration.

Stewart used the most susceptible experimental species, the baboon, whereas in other countries Macacus rhesus and Macacus inuus are used. From this the conclusion is drawn that the virulence of trachoma virus in Egypt is lower than elsewhere. The author also concludes that trachoma is spread by direct contact, and is not transmitted by flies and lice unless the virus is transferred mechanically.

Lawrence G. Dunlap.

Wilson, R. P. **Sulphonamide chemotherapy of trachoma.** Giza Mem. Ophth. Lab., 1937, 12th ann. rept., pp. 103-105.

Ten children with well marked trachoma of stages I to II a-b, all with pannus tenuis but no active keratitis and very little evidence of mixed infection, were treated with prontosil rubrum (Bayer) with no apparent effect upon the disease.

Lawrence G. Dunlap.

6

CORNEA AND SCLERA

Bessemens, A., and Van Canneyt, J. **Ocular tissue temperatures in the normal rabbit and in the rabbit affected with syphilitic keratitis.** Arch. d'Opht. etc., 1939, v. 3, Jan., p. 18. (See Section 17, Systemic diseases and parasites.)

Dalsgaard-Nielsen. **Correlation between syphilitic interstitial keratitis and deafness.** Acta Ophth., 1938, v. 16, pt. 4, p. 635.

The material consisted of 175 cases. Its analysis shows that 15.6 percent of cases with interstitial keratitis develop deafness; that the interval between the keratitis and onset of deafness varies from one to 31 years; and that deafness develops more frequently in patients in whom the keratitis runs a severe course. Ray K. Daily.

Friede, Reinhard. **On congenital endoderm-mesoderm hypoplasia of the eye and its relation to congenital cornea plana.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 16.

Hitherto cornea plana has been considered an independent malformation of the limbus and its immediate surroundings. After a critical review of all extant cases of endodermal, mesodermal, and ectodermal disturbance the author concludes that congenital cornea plana is a developmental disturbance which may involve all mesodermal parts of the eye in greater or lesser degree. Hypoplasia of the ectoderm is almost always combined with it in the form of severe amblyopia or even amaurosis. The underdevelopment of the endoderm is considered as primary, that of the mesoderm as secondary. The time of origin is probably the third or fourth embryonic month, and the cause a damage to primarily normal germ plasm. Hereditary transmission may be dominant. C. Zimmermann.

Gunderson, Trygve. **Results of autotransplantation of cornea into anterior**

chamber. Trans. Amer. Ophth. Soc., 1938, v. 36, p. 207. (See Amer. Jour. Ophth., 1939, v. 22, March, p. 322.)

Kamel, A. **Tebeprotein in diagnosis and treatment of certain eye diseases.** Giza Mem. Ophth. Lab., 1937, 12th ann. rept., pp. 100-103.

To determine the extent to which tuberculous allergy is a factor in certain Egyptian eye diseases and the effect of tebeprotein treatment upon cases showing tuberculous allergy, tebeprotein was given subcutaneously each week in nine of eighteen cases of recurrent corneal infiltration. Four cases had no recurrences after two to seven months of injections, and the remaining five cases had only mild recurrences and were all cured except one. Recurrences were brought about by trauma (painting of the lids with 1-percent mercury bichloride, expression of follicles, removal of concretions). Nineteen percent of the patients seen at the Giza Ophthalmic Hospital showed positive Mantoux tests, and the opinion is that recurrent corneal infiltrations are not trachomatous.

Different forms of keratitis profunda were also treated with tebeprotein, two with good results. Sclerokeratitis was similarly treated with clearing in the one case which completed the treatment. Episcleritis fugax appeared to respond well, as did iridocyclitis when given sufficient treatment.

Lawrence G. Dunlap.

Kayser, B. **On the impossibility of close genetic relations between macrocornea or megalocornea and hydrophthalmos.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 11.

Kayser contests the conclusion by vom Hofe (Klin. M. f. Augenh., 1938, v. 101, p. 105) that close genetic relations must exist between macrocornea and hydrophthalmos, because it has not been proved that macrocornea existed in his cases. Macrocornea and megalocornea are purely primary anomalies of growth and not pathological. The enlargement of the cornea in vom Hofe's hydrophthalmos families is easily explained as secondary to a fetal hydrophthalmos followed by partial arrest and later recrudescence.

C. Zimmermann.

Klar, R. **Observations and investigations on the diffusion of fluorescein in human and animal eyes.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 29.

Klar observed diffusion of aqueous solutions of fluorescein after instillation in the conjunctival sacs of patients with deep inflammatory corneal processes caused by external influences such as cauterization or explosion, or ulcers of varying causation. In experiments on the dog, rabbit, and monkey the fluorescein appeared in the anterior chamber after a half hour, by diffusion through the cornea (whether or not the latter had been previously injured), whereas fluorescein was never observed in the human anterior chamber after repeated instillations of the solution into the healthy conjunctival sac, in 0.5 to 5-percent strength. A 10-percent solution instilled about five times per hour penetrated the intact human cornea without causing irritation. In the human cases in which the parenchyma of the cornea had been damaged, diffusion of a 0.4-percent solution occurred.

C. Zimmerman.

Maghraby, A. A. M. El. **Biomicroscopy of deep keratitis.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 165.

A review of the slitlamp findings in 54 cases of deep keratitis is given.

Edna M. Reynolds.

Posthumus, R. G. **Megalocornea in relation to other anomalies in members of the same family.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 1.

Posthumus studied the genealogic tree of a family and describes three cases of megalocornea. He found that in these latter the eyeball was not enlarged, although the vitreous might be atrophic and the iris might show destruction of pigment. Especially the male members had hair lacking in pigment. Some of the patients had typical receding skull formation and slight mental debility. Megalocornea may occur familially in relation to labyrinthine deafness and diabetes, the men inheriting the megalocornea, the women diabetes, and both deafness.

C. Zimmermann.

Reitsch, W. **Cauterization of the cornea with non-glowing cautery.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 253.

A much less intense temperature than the 525 degrees Celsius of the dully glowing platinum wire is sufficient. It avoids destruction of the surrounding healthy cornea, and change of curvature from deep cauterization. The author makes the application between the objective of the corneal microscope and the patient's eye, and not nearer to the cornea than can be tolerated by the anesthetized eye without a sense of heat. C. Zimmermann.

Riad, Mahmoud. **Some observations on trachoma of cornea.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 159.

Following a description of the histologic structure of the cornea and the limbal vessels, the corneal changes occurring in all stages of trachoma are described and illustrated by slitlamp drawings and photomicrographs.

Edna M. Reynolds.

Vogt, A. **A further histologic picture of wavy folding of the parenchymatous lamellae at the apex of keratoconus.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 28.

Anatomic examination of the apex of a keratoconus of a man of sixty years showed within the thinnest portion a waving of the parenchymal lamellae, representing the substratum of the keratoconus lines, as in a case reported by Vogt. C. Zimmermann.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Barsoum, Labib. **A case of congenital cyst in anterior chamber of left eye with congenital anterior capsular cataract in both eyes.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 195.

Such a case is reported. The origin of the cyst was probably the pigmented epithelium of the iris from which it became separated to lie free in the anterior chamber. Edna M. Reynolds.

Blegvad, O. **The diagnosis of Boeck's iritis.** Acta Ophth., 1939, v. 16, pt. 4, p. 598.

The author disagrees with Osterberg, who contends that morphologically Boeck's iritis cannot be differentiated from tuberculous iritis. This applies to the serous type, which has no distinguishing characteristics outside of its frequent association with band keratitis. The nodular form, however, differs in appearance from a tuberculous nodule. The latter is smooth, dirty-white with a yellow tinge, and round or oval in form. It pushes forward through the iris tissue and is enveloped by blood vessels. After healing, the small nodules leave almost invisible scars, while the large ones leave atrophic areas in the iris tissue. In Boeck's iritis the nodules are frequently

large, irregular in contour and surface, reddish-yellow in color, and traversed by numerous fine blood vessels. They heal without atrophy or scars.

Ray K. Daily.

Blegvad, O. **Tuberculous iridocyclitis.** Oft. Selskab i Köbenhavn's Forhandlinger, 1937-1938, pp. 35-45. In Hospitalstidende, 1938, Dec. 13.

The author's presentation is based on the experiences with this disease at the Finsen Institute. As to diagnosis, he emphasizes the finding of tubercles in the iris. If these are present, differentiation must be made from three other types of iritis: (1) luetic, (2) metastatic glioma, and (3) Boeck's sarcoid. If no tubercles of the iris are found the diagnosis must be made by exclusion. For treatment the writer depends on injections of tuberculin in progressively increasing doses, and the use of ultraviolet light for one hour daily. He reports very encouraging results.

D. L. Tilderquist.

Jancke, G. **Formation of cysts in the iris after inflammation.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 248.

A woman of 38 years showed cysts in the atrophic iris. In very early life she had had iritis accompanying luetic parenchymatous keratitis.

C. Zimmermann.

Meyer, F. W. **Ocular tuberculosis and benign lymphogranulomatosis. (Boeck's sarcoid, multiple benign miliary lupoid).** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 76.

The histologic findings in an excised piece of skin from a case of retinochoroiditis and a glandular affection in a case of severe iridocyclitis, which are described in detail, confirmed the diagnosis of lymphogranulomatosis. This suggested a tuberculous etiology of the ocular affections. C. Zimmermann.

Robertson, J. D. **The fluid equilibrium of the body and its relation to the eye.** Brit. Jour. Ophth., 1939, v. 23, Feb., pp. 106-124.

In an article not lending itself well to abstraction the author demonstrates that dialysis is not a satisfactory explanation of the production of the aqueous humor; that the formation of this fluid is not governed by the simple laws which govern lymph; that when the osmotic equilibrium in the body is disturbed the fluid in the eye is similarly disturbed; that aqueous humor circulates from the posterior to the anterior chamber; that evidence places the formation of the aqueous humor in the ciliary process, and that the fluid leaves the eye by some process that is not osmosis, with no fluid leaving the eye normally by the posterior chamber. These conclusions substantiate former studies by the author. (See Amer. Jour. Ophth., 1937, v. 20, p. 1166, and 1938, v. 21, p. 705.) (Figures, references.) D. F. Harbridge.

Robertson, J. D., and Williams, P. C. **The creatinine, sugar, and urea equilibrium between plasma and lymph, aqueous humor, cerebrospinal fluid, and gastric secretion after a hypertonic injection of these solutions.** Jour. of Physiology, 1939, v. 95, Feb. 14, pp. 139-147.

A hypertonic solution of glucose, urea, and creatinine was injected intravenously into cats, and determinations of these substances were made on blood, lymph, gastric secretion, cerebrospinal fluid, and aqueous humor. The concentrations of these substances reach an equilibrium in blood and lymph, but at no time amount to even 50 percent of the blood values in the cerebrospinal fluid and aqueous. This is regarded as further evidence that these fluids are not simple filtrates of blood

plasma. However, analysis of aqueous reformed after evacuation of the anterior chamber shows values comparable to lymph, and indicates that in such instances the aqueous does resemble a filtrate of the blood.

George A. Filmer.

Vogt, Alfred. **The histology of iris efflorescences (iris tuberculids) in scrofulous iridocyclitis.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 246.

Vogt describes and illustrates efflorescences of the pupillary border in pieces of iris excised on account of secondary glaucoma in a man of fifty years and in a woman of 44 years. Histologically they showed foci containing lymphocytes, epithelioids, and giant cells, and occasional caseation.

C. Zimmermann.

8

GLAUCOMA AND OCULAR TENSION

Azmy, Youssef. **The normal ocular tension.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 5.

Examination with the Schiötz tonometer of one hundred normal eyes in patients from five months to 55 years of age showed an average tension of 22.4 mm. Hg. The lowest limit was 17 mm. Hg, and the highest 30 mm. Hg.

Edna M. Reynolds.

Bakly, M. A. El. **Surgical treatment of glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 65.

Methods of reducing high tension before operation are outlined. The indications for and the technique of the following operations are given: iridectomy, anterior sclerotomy, posterior sclerotomy, Lagrange sclerectomy, Elliot's sclero-corneal trephining, cyclodialysis, iridotasis, iridencleisis, seton drainage, incision of the angle of the anterior chamber, and Barkan's operation on Schlemm's canal. The routine treatment followed with cases of glaucoma in the ophthalmic hospitals of Egypt is stated. Edna M. Reynolds.

Bergler, Karl. **On trephine-cyclodialysis.** Klin. M. f. Augenh., 1939, v. 102, Jan., p. 49.

The author describes his modification of the technique of Sallmann (see Amer. Jour. Ophth., 1935, v. 18, p. 876), to which he refers, and reports his experiences with trephine-cyclodialysis in 45 cases of glaucoma (25 single, 9 chronic inflammatory, 3 acute, 8 secondary). He concludes that this operation is a valuable addition to glaucoma therapy. It is preferable to classical cyclodialysis for its greater technical simplicity and its rapid and usually durable effect. The manipulation of the spatula for detaching the ciliary body is possible over a greater area through the trephined hole. This explains the lasting benefit, as only an extensive detachment of the ciliary body gives the best possible result. C. Zimmermann.

Custodis, Ernst. **Unilateral hereditary hydrophthalmos and its hereditary succession.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 242.

Three sisters and two brothers of the patient had normal eyes; one brother and the patient had left hydrophthalmos. The patient was twice operated upon. He has four children of whom the only boy, aged 2½ years, showed soon after birth enlargement of the right eye for which he had been operated upon six months before the present examination. A digenetic dominant heredity seemed probable. The author is against sterilization for such cases if it cannot be proved by further study that unilateral hydrophthalmos fre-

quently occurs bilaterally in the descendants. C. Zimmermann.

Evans, J. J., and Evans, P. J. **Ocular changes associated with nevus flammeus.** Brit. Jour. Ophth., 1939, v. 23, Feb., pp. 95-105. (See Section 11, Optic nerve and toxic amblyopias.)

Friedenwald, J. S. **Contribution to the theory and practice of tonometry. 2. An analysis of the work of Professor S. Kalfa with the applanation tonometer.** Amer. Jour. Ophth., 1939, v. 22, April, pp. 375-381.

Griscom, J. M. **A modification of the Lagrange operation for simple glaucoma—results of the operation in 50 unselected cases.** Pennsylvania Med. Jour., 1939, v. 42, March, pp. 640-642.

The author considers that the greatest technical difficulty in the original Lagrange operation for simple glaucoma is in making the scleral section satisfactorily. He describes a modification of the operation in which the scleral flap is made first. A broad conjunctival flap is dissected to the limbus and held down by an assistant. With a cornea-splitting knife an incision 3 mm. long is made in the superficial layers of the sclera, 2 mm. above and parallel to the limbus. The point of a keratome is introduced into this scleral incision and is passed into the anterior chamber at the angle. The keratome is advanced over the anterior surface of the iris until the scleral incision is about 5 mm. wide, and then is quickly withdrawn. Next a piece of the scleral lip 1.5 mm. wide and 4 mm. long is excised. Finally a broad basal iridectomy is done and the conjunctiva sutured.

The author reports the results of this operation performed on fifty unselected, previously unoperated cases of simple glaucoma during the preceding nine years. In 45 cases, or 90 percent of the total, tension was reduced to within normal limits. In one case the operation was a failure, from prolapse of the ciliary body. In two cases the tension remained high, and in two other cases a moderate hypotension resulted. In no case did postoperative iridocyclitis or infection occur. (Discussion.)

George A. Filmer.

Ibrahim, F. G. **Syphilis among glaucomatous cases.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 40.

In a routine examination of 220 cases of glaucoma, 38 cases of syphilis were found, while among 142 patients with senile cataract, only 19 cases of syphilis were found. The author believes that syphilis may be one of the predisposing causes of primary glaucoma.

Edna M. Reynolds.

Ibrahim, S. A. **The value of cyclodialysis operation in glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 87.

A modification of Heine's cyclodialysis is described. It was found to give good results in the following types of case: (1) in chronic uncompensated glaucoma in which iridectomy had failed; (2) in cases of secondary glaucoma with adherent leucoma which had been operated upon unsuccessfully; (3) in cases of partial and total anterior staphyloma; (4) in cases of tattooing of corneal leucomas requiring an iridectomy before the tattooing; and (5) in cases of hypertension following successful extraction of the lens.

Edna M. Reynolds.

Jeandelize, P., Drourt, P. L., Thomas, C., and Bardelli, N. **Ocular tension, glaucoma, and the hypophysis.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 478-484.

Surveying the literature on the subject, the authors found that the ocular tension was low in states characterized by increased activity of the hypophysis, such as pregnancy, acromegaly, adiposo-genital syndrome, and Simmonds' disease, and was elevated in cases where the X rays demonstrated certain changes in the sella turcica. The hypophyseal extracts, especially those of the posterior portion, seemed to have a hypotensive effect in glaucoma. Partial hypophyseal removal, and the anterior hypophyseal extracts, caused hypertensive effects.

Clarence W. Rainey.

Kattan, M. A. El. **A brief comment on the pathological course of glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 17.

Since the intraocular fluids are a dialysate from the capillary blood, the tension of these fluids depends on intracapillary pressure in the choroid and ciliary body. This is maintained by regulation through the sympathetic nervous system. Normally a wave of increased blood pressure would stimulate the sympathetic system and produce contraction of the blood-vessel walls; thus guarding the normal intracapillary pressure. An aberration of this regulating mechanism or an increase in the permeability of the capillary walls such as we get in certain toxic conditions would allow the passage of large quantities of fluid. Edema thus set up in the vitreous pushes the lens, iris, and ciliary body forward, shutting the filtering angle. As a result of repeated attacks, the mere physical contact between the periphery of the iris and the cornea ends in gluing together of these two surfaces by exudate.

Recession of the lamina cribrosa in mild hypertension cases is explained as due to traction from behind, with a fibrosis following cavernous atrophy of the optic-nerve fibers. A brief discussion of exfoliative glaucoma capsularis is given. Edna M. Reynolds.

Khalil, Mohammed. **Lagrange's operation for glaucoma modified.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 79.

The Lagrange operation is used by the author for all types of glaucoma. The operation is modified by making a large conjunctival flap as in trephining, and then undermining the conjunctiva above the wound posteriorly in order to secure a larger space for direct filtration of the aqueous.

The Lagrange operation is preferred to the Elliot because (1) the iridectomy can be done more easily, (2) a linear gap in the sclera gives more extensive filtration, and (3) the limbus is left free for subsequent cataract extraction if necessary. Levoglaucosan or atropine is used postoperatively to prevent posterior synechiae.

Edna M. Reynolds.

Lottrup-Andersen, C. **Adrenalin treatment of glaucoma simplex.** Acta Ophth., 1939, v. 16, pt. 4, p. 611.

The author is very enthusiastic about the effectiveness of adrenalin tampons in reducing intraocular pressure. (11 case reports.) Ray K. Daily.

Maghraby, A. **Glaucoma capsularis.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 42.

The clinical findings in 19 cases of capsular glaucoma are reported. This condition plays a part in 8 to 12 percent of glaucoma cases. Its onset is insidious with no acute symptom, only a sense of heaviness and discomfort which rarely ceases and is accompanied by gradual failure in vision. Without slitlamp examination, the cases pass as simple

immature cataract and are told to wait for maturity and extraction of the cataract. The failure in vision is due (1) to the slight increase of tension commonly present and (2) to varying amounts of lens opacity. Visual acuity in the cases reported ranged from 60/60 to 6/36. The disease usually occurs in older people. The average age in this group was 65 years.

Sixteen of the 19 cases showed increased tension, the highest reading being 45 mm. Hg and the other cases varying from 5 to 10 mm. above normal. The limits of normal tension in these cases are lower than in ordinary glaucoma. A tension of 22 to 25 mm. Hg is high when associated with exfoliation of the lens capsule. The outstanding feature when viewed with the slitlamp is the bluish-white fluffy masses attached to the pupillary border of the iris. Exfoliation of the superficial lamellae of the lens capsule is the second outstanding feature of the disease. It is seen as fine bluish-white scales on the anterior surface of the lens. Histopathologic examination of excised iris tissue shows slight atrophy with hyaline thickening of blood vessels. Lightly stained reticular masses occur at the pupillary border and in the furrows on the posterior surface of the iris.

Broad iridectomy is the operation of choice for treatment. Although tension may be restored to normal, gradual failure of vision occurs because of the accompanying lens opacity.

Edna M. Reynolds.

Massoud, Farid. **Extraocular influence in glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 32. (See Amer. Jour. Ophth., 1938, v. 21, Jan., p. 82.)

Maziny Be, E. H. El. **Statistical review on glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 1.

The percentage of glaucoma cases among the patients examined in the ophthalmic hospitals of Egypt shows a steady decline from 1921 (1.77 percent) to 1935 (0.73 percent). This is attributed to increased familiarity of the general population with the ophthalmic hospitals, resulting in earlier care of patients and consequent reduction in the incidence of glaucoma.

Edna M. Reynolds.

Mohamed, I. A. **Synopsis on the pathology of glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 22.

The fact that increased tension is not always the earliest sign of glaucoma is emphasized. Field defects are given more diagnostic value than hypertension. Senile and hypermetropic eyes are predisposed to glaucoma because the root of the iris lies near the corneoscleral junction and thus produces a shallow filtration angle.

The histopathology of the glaucomatous eye is described. In chronic compensated glaucoma, the angle of the anterior chamber is always free of anterior synechiae. The atrophic patches which occur in the iris are attributed to obliteration of certain branches of the anterior ciliary arteries. The cupping of the optic nerve is attributed, not to weakness of the fibrous coat at the lamina cribrosa, but to cavernous atrophy of the nerve fibers due to ischemia. When the lamina is deprived of its support through softening of the nerve fibers it recedes.

Edna M. Reynolds.

Redslob, M. E. **Attempts at treatment of chronic glaucoma by acidification of the vitreous.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 485-490.

Since the amount of swelling of the vitreous is markedly reduced by lower-

ing of the PH, the author tried introduction of 0.7-percent phosphoric acid into the vitreous as a means of lowering the tension in a series of eyes blind from chronic glaucoma. The results were encouraging. In some cases 2-percent phosphoric acid was used. The eyes stood the process very well. The hypertension was reduced by one or two injections, after which pilocarpine had a markedly increased effect.

Clarence W. Rainey.

Ridley, Frederick. **An "active (histamine-like) substance" in the tears.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 2, p. 590.

After reviewing the work and reports on the action of histamine and histamine-like substances in glaucoma, the author concludes from his experimental work that tears normally contain an active histamine-like substance in sufficient quantity to give rise to a wheal and flare on injection into the skin. The aqueous normally contains a substance capable of inhibiting or destroying this substance, and there is evidence that the aqueous of patients suffering from simple glaucoma is deficient in it. Beulah Cushman.

Schmelzer, H. **Glaucoma and hepatopathy.** Klin. M. f. Augenh., 1939, v. 102, Feb., p. 231.

In systematic examination of the metabolism of 55 patients affected by primary glaucoma, and of 45 controls with normal ocular tension, the author found in glaucoma a noticeable hypercholesterinemia, positive xanthoprotein reaction, and increased bilirubin in the serum. He assumes that a large number of the glaucoma patients suffered from functional disturbances of the liver and that suitable general treatment might exert a favorable influence on the tendency to glaucoma. He proposes a special diet, to "spare the liver," beside local treatment. C. Zimmermann.

Sjögren, Henrik. **Allergically conditioned changes in intraocular tension.** Acta Ophth., 1938, v. 16, pt. 4, p. 542.

In a 34-year-old woodworker, the handling of certain types of wood induced attacks of unilateral nasal obstruction, edema of the lids, chemosis of the conjunctiva, transitory myopia, hypotension, and obliteration of the anterior chamber. Ray K. Daily.

Sobhy Bey, M. **How to keep filtration in recent sclerectomies.** Bull. Ophth. Soc.. Egypt, 1937, v. 30, p. 91.

Frequent atropinization beginning a few days after operation, to provoke increased tension and force the aqueous to pass through the scleral defect, supplemented by milk injections or other foreign-protein therapy to prevent active hypotony of the globe—this is the method advised to insure filtering scars.

Edna M. Reynolds.

Suleiman Pasha, S. A. H. **The normal intraocular pressure in Egyptians.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 11.

The tension of 675 patients ranging in age from 10 to 50 years is reported, together with measurement of corneal diameters and blood pressure. No direct relation between blood pressure and intraocular pressure was found, nor was there any constant relationship between intraocular pressure and corneal diameter.

In the male patients under twenty years of age, the average tension was 22 mm. Hg (Schiötz); between 20 and 40 years of age, the average tension was 20 mm. Hg; and between 30 and 50 years of age, the average tension was 18.5 mm. Hg. In the female pa-

tients between 20 and 30 years of age the average tension was 20 mm. Hg. The tension for 675 cases varied from 11 to 25 mm. Hg.

Edna M. Reynolds.

Tobgy, A. F. El, and Attiah, M. A. H. **The early diagnosis and treatment of glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 42.

The importance of study of the variations in intraocular pressure is stressed, and the daily tension curve of the glaucomatous eye is compared with that of the normal eye. A series of provocative tests is outlined for use in cases suspected of glaucoma where the tension curve gives inconclusive evidence. Arecoline hydrobromide is mentioned as a substitute for eserine.

Edna M. Reynolds.

Weinstein, Paul. **Etiology of glaucoma.** Brit. Med. Jour., 1939, March 4, pp. 436-437.

An investigation undertaken to find a possible relation of glaucoma to blood pressure. The pressure in the ocular vessels was measured by a tonograph, and studies were made on cases of inflammatory, primary, and secondary glaucoma. It was concluded that the circulatory system was intimately involved in the glaucomatous condition, and it was believed that endocrine dysfunction in glaucomatous patients exerted its effect through the circulatory system.

George A. Filmer.

Wilson, R. P. **Incidence of glaucoma.** Bull. Ophth. Soc. Egypt, 1937, v. 30, p. 4.

Figures for incidence of blindness due to glaucoma in a typical Egyptian village are given and compared with similar figures obtained from the Egyptian ophthalmic hospitals. These are found to agree closely. The figures are higher than in other countries, a fact for which the prevalence of trachoma is held responsible.

Edna M. Reynolds.

Wilson, R. P. **Primary glaucoma and adrenal-cortex extract.** Giza Mem. Ophth. Lab., 1937, 12th ann. rept., pp. 105-108.

Intramuscular injections of cortin in three cases of chronic primary glaucoma failed to have any beneficial effect upon the increasing intraocular pressure. On the contrary, the administration of cortin was actually associated with a slight increase in intraocular pressure.

Lawrence G. Dunlap.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
640 S. Kingshighway, Saint Louis

News items should reach the Editor by the twelfth of the month

Deaths

Dr. Lyman R. Forgrave, Saint Joseph, Missouri, died March 9, 1939, aged 64 years. For many years he was active in the American Academy of Ophthalmology and was a member of its Council.

Dr. Robert Sattler, Cincinnati, Ohio, died February 10, 1939, aged 84 years (see Obituary).

Miscellaneous

The American Board of Ophthalmology will conduct a written examination in various cities of the United States, in Honolulu, and Porto Rico, as well as in Canada, on August 5th. Formal application for this examination must be received before July 1st. Oral examination for successful candidates will be held on October 7th, at Chicago. For application blanks and information, please write at once to the Secretary, Dr. John Green, 6830 Waterman Avenue, Saint Louis, Missouri.

The "Amblyopia Reader," written by Dr. Margaret Dobson and published in England, is considered a successful means of stimulating vision in the amblyopic eye. It is also widely used to detect hyperphoria, and in diagnosing defective vision of one eye in cases of refractive errors and congenital blindness. It comes complete with equipment and directions as to technique. Copies of the Reader can be secured from the American Optical Company, Southbridge, Massachusetts.

The course entitled "A Survey of eye conditions" (4 points credit) will be available to students planning to attend New York University summer session. This course offered by New York University since 1932 in coöperation with the Bureau of Services for the Blind, New York State Department of Social Welfare, has become increasingly popular because of the material offered relative to sight conservation and prevention of blindness. It is designed for workers in the fields of education, social welfare, public-health nursing, and allied fields. It is planned to present a background of the conservation of sight together with an appreciation of the medical, social, and educational needs and responsibilities in relation to acute and chronic eye conditions. Lectures will be supplemented by clinic demonstrations.

Please address inquiries regarding registration to Mr. James Meyers, Director of Course, School of Education, New York University, Washington Square, New York City.

The following program is announced for the Seventeenth Annual Summer Graduate Course in Ophthalmology, Denver, Colorado, July 24 to August 5, 1939: Clinical photography of the eye, illustrated, by Dr. Arthur J. Bedell, Albany, New York; Practical office methods. Diagnosis and treatment of corneal diseases, by Dr. Harold Gifford, Omaha, Nebraska; The trachoma problem in the United States. Some aspects of glaucoma, by Dr. Harry S. Gradle, Chicago; Prevention of cataract. Cataract operations, by Dr. Richard W. Perry, Seattle, Washington; Consideration of retrobulbar neuritis. Operative treatment of retinal detachment, by Dr. Lawrence T. Post, Saint Louis, Missouri; Viruses and virus diseases of the eye. Chronic conjunctivitis. Sulfanilamide and other chemotherapeutic agents for ocular diseases, by Dr. Phillips Thygeson, New York City; Physiologic optics, by Dr. William H. Crisp, Denver, Colorado; Cataract operations, by Dr. Edward Jackson, Denver, Colorado.

A course in Visual optics and physiology will be given at Harvard Medical School by Drs. Ludvigh, Cogan, and Easton, in July, daily at 9 A.M. to 5 P.M. The attendance is limited to eight. Women are admitted. The fee, $150.00. With the collaboration of Drs. Verhoeff and Lancaster, this course will be given for those who desire to teach or to do research work in physiological optics. Instruction will include lectures and laboratory work on the following general subjects: reflection, refraction, refractive errors of the eye, accommodation, ophthalmoscopy, retinoscopy, reduced eye, aberrations of the eye, ocular motility, binocular vision, relation between retinal structure and function, visual acuity, light sense, color vision and color blindness, entoptic phenomena, optic-nerve impulses, visual illusions, pupillary reflexes, and intraocular pressure.

The Tenth Annual Summer Graduate Course in Ophthalmology will be held in Rochester, New York, July 24 to 28, 1939. Guest lecturers will be Dr. William Thornwall Davis; Dr. Albert D. Ruedemann, Dr. Sidney L. Olsho, Dr. F. Bruce Fralick, Dr. Martin Cohen, Dr. Clyde A. Clapp, Dr. Donald J. Lyle, Dr. Arthur M. Yudkin, Dr. Ramon Castroviejo, Dr. Harvey E. Thorpe, and nonmedical lectures by the Bausch and Lomb Optical Co. staff; and the guest of honor, Dr. Albert C. Shell. The fee, $40.00. Further information from Dr. John F. Gipner, Strong Memorial Hospital, Rochester, N.Y.

Societies

The Third Brazilian Congress of Ophthalmology will be held in Bello Horizonte, July 5 to 12, 1939. The principal subjects are "Surgical treatment of strabismus" by Professor Alvaro, and an address on "Metabolism and the eye."

The Oxford Ophthalmological Congress will convene on July 6-8, 1939, inclusive, Mr. Percival J. Hay being Master of the Congress.

Announcement is made of the formation of the New Haven Ophthalmological Society. The first meeting was held on April 17, 1939. Dr. Eugene M. Blake, 303 Whitney Avenue, New Haven, Connecticut, is president, and Dr. Frederick A. Wies, 255 Bradley Street, New Haven, Connecticut, is secretary.

The dinner meeting of the Cleveland Ophthalmological Club was held February 21, 1939. The guest speaker was Dr. Benjamin Rones of Washington, D.C., who spoke on "Ocular senility."

At the dinner meeting of the Cleveland Ophthalmological Club, held April 4, 1939, all the speakers were local members. Dr. H. H. Shiras spoke on "Use of sulfanilamide in eye diseases." A disscussion of this paper was opened by Dr. M. W. Jacoby. Dr. H. V. Phelan spoke on "The fields of vision in multiple sclerosis"; discussion by Dr. Lorand V. Johnson. Dr. A. B. Bruner spoke on "Refinements of technique in cataract surgery"; discussion by Dr. R. E. Thaw.

At this meeting the following officers were elected: Dr. A. D. Ruedemann, president; Dr. Carl McDonald, vice-president; Dr. B. J. Wolpaw, secretary and treasurer.

The International Assembly of the International College of Surgeons met at the Hotel Roosevelt, New York City, May 21 to 25, 1939.

Personals

Dr. Arthur J. Bedell of Albany, New York, has returned from London, England, where as an especially invited guest he addressed the Ophthalmological Society of the United Kingdom, on "Fundus changes in diabetes" and demonstrated several hundred of his fundus photographs in color. He was accompanied on the trip by Mrs. Bedell.

Dr. W. E. Bruner, Professor Emeritus of Ophthalmology, Western Reserve University, School of Medicine, recently returned from a six weeks holiday to the West Coast.

Dr. Paul Motto, Clinical Professor of Ophthalmology, Western Reserve University, School of Medicine, spoke recently before the Section on Ophthalmology of the Ohio State Medical Society, at Toledo. His subject was "The management of hyperphoria."

Dr. Charles Thomas, until recently Resident Ophthalmologist of the University Hospitals of Cleveland, announces the opening of his office in the Carnegie Medical Building, Cleveland, Ohio.

A recent visitor to the Cleveland Eye Clinics was Dr. Ernest Krug, Associate Professor of Ophthalmology, Columbia University. Dr. Krug was a former resident of Cleveland.

Dr. Walten Holt McKenzie announces the opening of his office at Suite 1607 Medical Arts Building, Fort Worth, Texas.

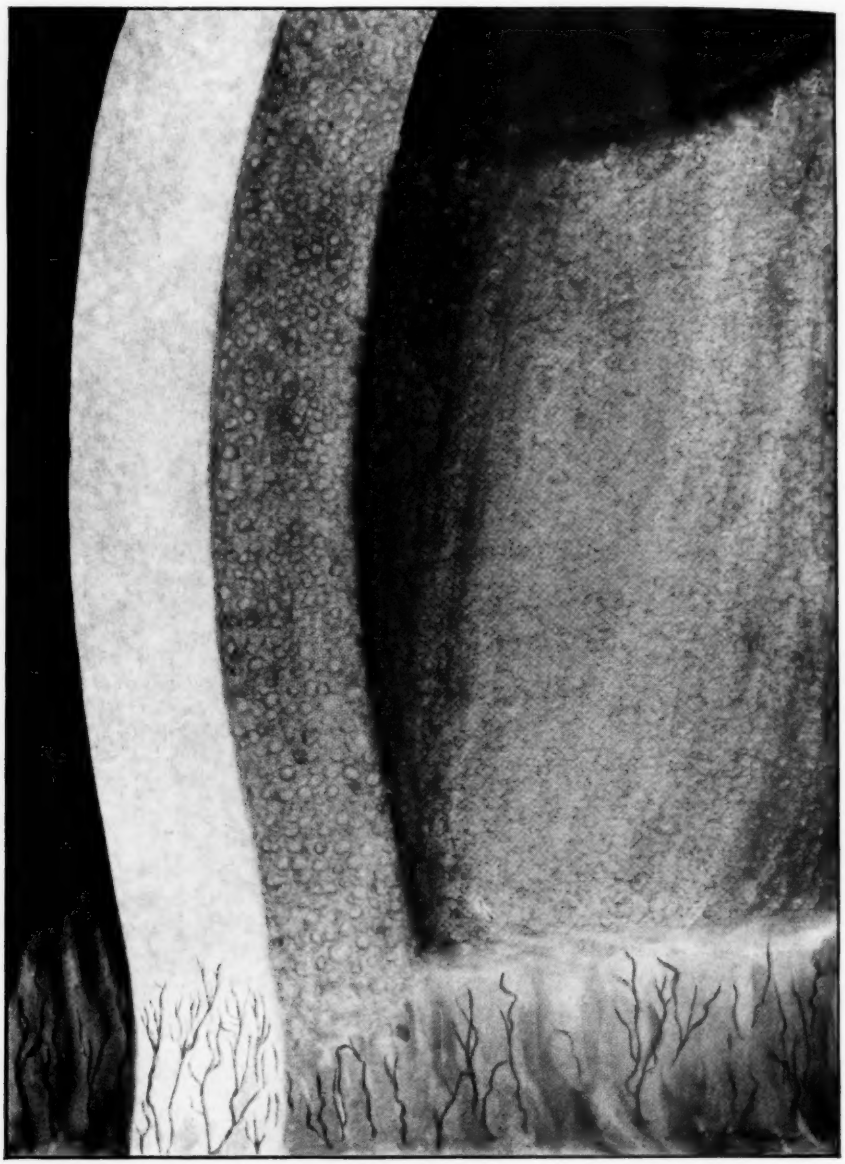

FIG. 11 (MEYER AND OKNER). SLITLAMP VIEW OF CORNEAL CHANGES IN DYSOSTOSIS MULTIPLEX.